Vol. 52 No. 4 April 1959

Quarterly

of the

National Fire Protection Association

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Vol. 52 No. 4 April 1959

Quarterly

The Standard Technical Journal of Fire Protection for More Than Fifty Years

The NFPA is a non-profit technical and educational organization devoted to the reduction of loss of life and property by fire with a total membership of 17,000. The *Quarterly* is one of the publications regularly provided to members. Other membership publications include *Fire News*, *Advance Reports* to the Annual Meeting, a *Year Book*, and many leaflets, pamphlets and posters issued throughout the year on fire prevention and control. Six volumes of the National Fire Codes are available on an annual subscription basis, one volume free and others at reduced membership rates. For full details on available material ask for a free list of "Publications on Fire Prevention and Protection."

NFPA annual dues are $15.00 for Associate Membership of which $6.00 is for subscription to this Journal. National and regional societies or associations may apply for an organization membership for which annual dues are $100; such a membership entitles four individuals to receive the periodical membership publications.

Technical committees of the Association develop means to safeguard life and property through the publication of standards covering all phases of fire prevention and protection. Your membership in the Association affords an opportunity to keep abreast of these developments and, by being a member, you help support this humanitarian activity. Popular educational literature on fire safety is constantly being produced by the NFPA for distribution through its members to the general public.

National Fire Protection Association

International

60 Batterymarch Street Boston 10, Mass., U.S.A.

Entered as second-class matter December 15, 1928, at the Post Office at Boston, Mass., under act of March 3, 1879.

Printed in U.S.A.

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International

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Quarterly

of the

NATIONAL FIRE PROTECTION ASSOCIATION

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Vol. 52 No. 4 **April 1959**

Table of Contents

School Dormitory Fire, Wrightsville, Ark. . . . . Frontispiece

Meeting of Board of Directors 231

Large Loss Fires of 1958
Introduction 235
Building Fires — Cause of Fire 237
Building Fires — Time, Place and Origin 245
Building Fires — Detection of Fire 249
Building Fires — Alarm of Fire 257
Building Fires — Spread of Fire 263
Building Fires — Private Fire Protection 289
Building Fires — Public Fire Protection 307
Fires Not in Buildings 319
Conclusion 335
Table I 337
Table II 341

Use of Combustible Gas Indicators
N. W. Hartz, Mine Safety Appliance Company 357

Fire Record of Cities 366

Reviews and Abstracts of Technical Papers 374

Index to Volume 52, NFPA QUARTERLY 378

Index to Advertisers 388

Articles and accounts of fires appearing in the Quarterly are based on material forwarded to the Association. The Association, as a body, does not assume responsibility for the accuracy of the material printed herein.

This publication is indexed by Engineering Index, Inc.

Wide World

On March 5, 1959 a night fire in a dormitory at the state-run boys' industrial school in Wrightsville, Ark., killed 21 boys and injured numerous others. The 1-story, brick-veneered, wooden building had "escape-proof" screens at each window (shown in rubble above) and the boys were locked in for the night. The lack of an automatic sprinkler system, the combustible construction of the building, and the failure to provide a substitute for the sick, key-carrying building caretaker were the principal ingredients which could have forecast the tragedy had anyone analyzed the conditions. Starting when the vent to a wood-fired stove ignited the combustible fiberboard ceiling, the fire spread in the undivided attic. Twenty-one of the 68 boys were trapped while the others miraculously managed to break down screens and escape.

Meeting of Board of Directors

Union League Club, New York, January 22, 1959

Members Present

T. Seddon Duke, Chairman
Henry G. Thomas, President
Loren S. Bush, Vice-President
J. Sharp Queener, Vice-President
John A. Neale, Past President
Hovey T. Freeman, Secretary-Treasurer

Dale K. Auck
Warren J. Baker
W. H. Berry
Charles H. Bunn, Jr.
Marshall B. Dalton
W. H. Forristall
A. Leslie Ham
Clarence W. Higbee
Paul C. Lamb
Jerome Lederer
William L. Miller
John H. Redmond
George J. Richardson
Leigh R. Sanford
Udell C. Young

Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary; Horatio Bond, Chief Engineer; Charles S. Morgan, Assistant General Manager; George H. Tryon, Assistant Technical Secretary; Merwin Brandon, Chairman, Electrical Section; E. Kenneth Clark, former Board member.

Business Transacted

1. The Board voted to confirm the holding of the 1959 annual meeting at the Hotels Dennis and Shelburne, Atlantic City, N. J., June 1–5, 1959. Mr. Bugbee reported progress to date on the development of the program and solicited suggestions from members of the Board.

Mr. Bugbee made reference to the tentative scheduling of future meetings as follows: 1960, May 16–20, Montreal; 1961, May 15–19; Detroit; 1962, May 14–18, Philadelphia; 1963, May 20–24, San Francisco; 1964, May 18–22, Dallas.

2. Treasurer Hovey T. Freeman presented a financial report indicating that the Association is in good financial condition but warning members of the Board that the margin between income and expenses is small and that every effort must be made to continue economical operation of the Association's affairs.

Staff Activities

3. Executive office reports were presented as follows:

a. Mr. Bugbee reported on membership indicating a membership slightly less than 17,000, representing little change since May 1. He felt confident that the membership by the time of the next annual meeting would exceed 17,000.

b. Mr. Bugbee reported for the Sponsors Committee indicating the acceptance of chairmanship of the Sponsors Committee by Mr. H. E. Humphreys, Jr., Chairman of the Board of the United States Rubber Company. He also gave the names of the other distinguished members. The report was approved.

c. Mr. Moulton reported on publications, indicating the issuance of 117 new publications during the past year. More than 8 million pieces of literature were published and 39,250 orders and requests for publications were received.

d. Mr. Morgan reported on advertising, indicating a small increase in advertising income for the QUARTERLY and a healthy condition for other advertising activities.

e. Mr. Bugbee reported for the Public Relations Department commending the services of Mr. Deuel Richardson, NFPA Public Relations Manager, and indicating a highly successful operation of this department.

f. Mr. Bond reported on the Fire Service Department of which Mr. War-

ren Y. Kimball is in charge, indicating the extent of their activities and the increasingly successful results.

g. Mr. Moulton reported on the Fire Record Department, commending Mr. Chester I. Babcock, Manager, and outlining the activities of this department, with particular reference to recently published reports on the Chicago school fire and Bogotá department store fire. The Chicago report was discussed and the activities of the Association were commended.

h. Mr. Brandon, Chairman of the Committee on Electrical Field Service, reported that Mr. Frank Stetka, present Electrical Field Engineer, is operating successfully and outlined the various activities in the Electrical Section and in the various National Electrical Code Panels which will lead to the preparation of the 1959 National Electrical Code. This report was accepted.

i. Mr. Bunn, Chairman, Flammable Liquids Field Service Committee, reported on this division of the Association's activities, commending the services of Mr. Miles E. Woodworth, Flammable Liquids Field Engineer. He stated that while the project was now in the black there was an accumulated deficit which he hoped could be made up by increased contributions.

j. Chief Henry Thomas reported on the Gases Field Service activities, commending the work of Mr. Clark F. Jones, Gases Field Engineer, and indicating the need for further financial support. Reference was made to the favorable publicity given to this project by the Liquefied Petroleum Gas Association.

k. Mr. Tryon reported on the Handbook of Fire Protection, describing the activities of the NFPA office in developing the new text, indicating the many problems that have developed as a result of the necessity of coordinating this work with the regular staff responsibilities. He indicated the plan to have the book ready early in 1960.

Reports of NFPA Sections

4. Mr. Morgan reported on the activities of the Fire Marshals' Section, including the Section's desire to resume its original name, "Fire Marshals' Association of North America." It was explained that this change would indicate more specifically the character of the organization. No change in the status of its NFPA affiliation as a Section is contemplated. This proposal was approved.

a. Mr. Warren Baker, Vice-President of the Society of Fire Protection Engineers, reported for the Society, indicating a total of 1005 members, current operations in the black, and widespread interest in Society activities.

Meeting at Pittsburgh

5. Mr. Bugbee reported on the 1958 Fall Conference in Pittsburgh and plans for holding the 1959 Fall Conference in Des Moines, Iowa. The 1958 Conference was discussed by Messrs. Duke, Auck, Baker and Bunn, all indicating that these meetings are highly successful and should be continued.

Sparky Campaign

6. Mr. Bugbee reported on the Sparky campaign, indicating that this phase of the Association's activities is continuing its successful operation and that widespread publicity is resulting from the use of the Sparky symbol. He reported that since the Advertising Council had dropped the Sparky campaign the NFPA has continued this independently and has continued to receive contributions and royalties in support of the campaign. He reported the current plan to write off the previously accumulated deficit to the ex-

tent of $10,000 each year to be taken from working capital. This report was approved.

Farm and Rural Field Service

7. Mr. Bugbee made a report on the progress in soliciting funds for a farm and rural field engineering service, indicating that this project had now been taken up by the National Association of Mutual Insurance Companies. He expressed hope that their campaign would be successful and that once a substantial sum had been secured through mutual insurance sources other funds could be solicited successfully to put the project into operation.

Committee on Visual Education

8. Mr. Morgan reported on the Committee on Visual Education, indicating that this committee had been discharged by the Board at its last meeting but that there was continuing need for the committee to direct the Association's activities in this field and to sponsor the film library which is operated by the Western Actuarial Bureau in the name of the Association. It was voted to reconstitute the committee and to appoint Mr. Emmett Cox of the Western Actuarial Bureau of Chicago as Chairman.

Other Reports

9. Mr. Bond reported on the Industrial Committee, indicating the valuable function it performs and its usefulness in relations with the National Safety Council and other organizations.

10. Mr. Moulton reported on problems in committee organization with particular reference to the increasing importance of NFPA committee work and the difficulties in securing satisfactory representation, particularly from fields lacking a strong organization of the commercial interests affected. He referred to the formation of the Committee on Building Materials which furnishes a point of contact for diverse building material interests and makes it feasible to have a single representative on certain committees rather than multiplicity of representation of diverse interests.

11. On motion of Chief Thomas, Mr. Everett W. Fowler was appointed as a member of the Technical Advisory Committee to replace John A. Neale, resigned.

Technical Advisory Committee Report

12. Mr. Duke, Chairman, reported for the Technical Advisory Committee and the Board, on recommendation of the committee, voted to take the following actions:

a. Discharge the Committee on Special Extinguishing Methods and constitute the several subsidiary committees in this group as independent committees reporting directly to the Association.

b. Create a new Committee on Foam-Water Sprinklers to include representatives of the Sprinkler Committee, the Foam Committee, and manufacturers of equipment, with a neutral chairman.

c. In recognition of the importance of measures for the prevention of windstorm damage, advise the various technical committees that it is within their prerogative to cover in their various standards provisions against windstorm damage in so far as they may feel it appropriate to do so in the individual standards and to recommend to the NFPA staff that a chapter on windstorm damage be inserted in the next edition of the NFPA Handbook of Fire Protection and that a QUARTERLY article on this subject be published when appropriate.

d. On the subject of interim amendments of technical standards, revise the

Regulations on Technical Committee Procedure to provide that any committee wishing to release an interim amendment must clear their recommendations through the Technical Advisory Committee which will release interim amendments where it appears that there is a substantial majority of the committee favoring the interim amendment and an immediate need for the release of the information, provided, however, that where any committee has secured authorization from the Association for the release of interim amendments, as in the case of the Electrical Correlating Committee, clearance through the Technical Advisory Committee will not be necessary.

e. A proposal that standards established for the storage of polystyrene foam be referred to the Committee on General Storage, with instructions to consider the storage of all foam or sponge-like materials of a combustible nature including foam or sponge rubber, polystyrene foam and other similar materials.

f. Approval of the proposed reorganization of the Aviation Committee. This entailed discharge of the Committee on Aircraft Hangars, Committee on Aircraft Maintenance and Storage, and the Committee on Aviation and Airport Fire Protection with its subcommittees. New committees established were the Committee on Aviation and the following sectional committees; Aircraft Hangars and Airport Facilities, Aircraft Maintenance and Servicing, Aircraft Rescue and Fire Fighting.

Committee Appointments

13. Committee appointments were confirmed on recommendation of the Technical Advisory Committee, including the following new committee chairmen. (The individual committee members are not listed in these minutes, but their names will be printed in committee reports and in the 1959 NFPA Year Book.)

AVIATION: Jerome Lederer, Flight Safety Foundation, Chairman; Sectional Committee on Aircraft Hangars and Airport Facilities: H. F. Blumel, Jr., American Airlines, Chairman; Sectional Committee on Aircraft Maintenance and Servicing: Joseph M. Chase, Flight Safety Foundation, Chairman; Sectional Committee on Aircraft Rescue and Fire Fighting: R. C. Byrus, University of Maryland, Chairman; BUILDING MATERIALS: Capt. Carroll E. Shaw, Connecticut State Police, Chairman; CARBON DIOXIDE: H. T. Johnson, Illinois Inspection Bureau, Chairman; VISUAL EDUCATION: Emmett T. Cox, Western Actuarial Bureau, Chairman.

It was also voted to confirm the appointment of the various committee members appointed by the Technical Advisory Committee subsequent to the July meeting of the Board and included in the 1958 Year Book.

Other Business

14. Mr. Bond reported on developments in the field of civil defense and the current activities in this field conducted by the Office of Civil and Defense Mobilization.

15. Mr. Bugbee reported on a legal case in which a manufacturer of automatic fire alarm equipment in connection with his suit against Underwriters' Laboratories required Mr. Bugbee to answer some 85 questions. He indicated that he felt this was an imposition but that he was compelled by the court to provide answers to the questions.

Mr. Bugbee also reported on a case where a representative of nursing home operators in Wisconsin had made a statement at a public hearing making improper allegations of NFPA motives and activities. Mr. Bugbee stated that a letter had been written to the representative in question demanding that he withdraw his statement.

Large Loss Fires of 1958

An NFPA Fire Record Department Study

This study highlights the major fire protection failures of the year. Here are the errors of judgment, here is the equipment that didn't work, here is the planning that was never done. Few fields of endeavor are fortunate enough to have their mistakes so clearly available for review, study and correction.

Statistical Summary

During 1958 there were 356 fires and explosions in the United States and Canada causing losses of at least $250,000 each. Of these, 64 involved losses of $1,000,000 or more. The total loss resulting from the 356 fires was $294,777,500. The number of large loss fires in 1958 was 67 less than the 422 in 1957, and was 74 less than the record 430 in 1956. Excluding aircraft fires, 306 large loss fires caused $165,227,500 loss in 1958. Corresponding figures for 1957 were 360 fires and $242,750,500.

Aircraft fires are separately treated. See page 325.

In the 356 large loss fires in 1958 there were 263 deaths (includes 195 aircraft fire fatalities) and 1,224 nonfatal injuries (aircraft injuries not included).

The 356 large losses represented about 0.02 per cent of the total number of fires last year but caused approximately 20 per cent of the total dollar loss. Because of the effect of the few "large loss" fires on the annual total fire waste and also because of the many inevitable indirect losses resulting from such fires that cannot be measured in dollars, they have been carefully analyzed each year by the Fire Record Department of the NFPA and the results published in the QUARTERLY.

Geographical Distribution

Two hundred and sixty-one of the large loss fires occurred in the United States, 30 in Canada. States with the greatest numbers were Ohio with 29, Illinois 20, California 18, Pennsylvania 17, New Jersey 16, New York 15, Michigan and Texas 10 each. In Canada, the Province of Ontario had 15 large loss fires, Quebec 8. Transportation and forest fires are not included in this geographical summary.

Occupancy Distribution

The following table shows the 1958 changes in occupancy classifications. The changes are rather abrupt when viewed in the light of the last two years' unusual experience, but seem quite reasonable when compared with the experience of the early fifties.

No. of Large Loss Fires by Years

	1958	1957	1956	1955	1954
Industrial	85	125	117	78	75
Mercantile	81	58	53	50	54
Storage	43	55	50	41	54
Residential	10	17	24	9	11
Miscellaneous	82	101	94	68	62
Transportation	55	66	92	70	57
Totals	356	422	430	316	313

The only increase was a 41 per cent gain in large loss mercantile fires. The decreases were led by a 73 per cent drop in church fires (15 to 4), a 41 per cent drop in residential fires, a 32 per cent drop in industrial fires, a 22 per cent drop in storage fires, a 17 per cent drop in transportation fires and a 21 per cent drop in the "miscellaneous" classification.

Definition of "Large Loss"

A total direct fire loss, to buildings, stock, machinery and other tangible assets, of over $250,000 is defined as a "large loss" for the purpose of this analysis. The total direct loss is the sum of the *insured* and *uninsured* direct losses. In previous years the *indirect* insured losses were also included in the determination of whether or not a fire was a large loss. Had this procedure been used in 1958 there would have been 4 more large loss fires.

Every large loss fire involves serious indirect losses. Most of these losses however cannot be readily measured. Business interruption, rental and other *insured* indirect losses, where known, are shown in Table II, page 341.

Though every effort has been made to determine the actual loss in each case, the loss figures given should be considered approximate rather than actual.

This Year's Large Loss Study

The body of the 1958 large loss report is arranged differently than in previous years. This format is designed to highlight the factors responsible for large loss fires rather than to stress the type of properties (occupancies) involved. Occupancy factors, where important, are covered in the NFPA Occupancy Fire Records.*

With the foregoing in mind this year's report consists of a series of articles dealing with the significant features of the building fire experience followed by a separate article on the "Large Loss Fires Not in Buildings." Summaries of fires are included to illustrate significant factors.

Each large loss fire is the result of a combination of factors. While a report on a particular fire may appear as an illustration of one factor, the write-up on each fire is intended to show all the major factors which were involved in the particular loss.

The series of articles on the large loss building fires cover the following subjects:

	Page
Cause of Fire	237
Time, Place and Origin of Fire	245
Detection of Fire	249
Alarm of Fire	257
Spread of Fire	263
Private Fire Protection	289
Public Fire Protection	307

The report on "Large Loss Fires Not in Buildings" (page 319) describes fires involving property outside of buildings with separate reports on forest fires and transportation fire experience (aircraft, railroad rolling stock and ships).

The 1958 Large Loss Fire report ends with a "Conclusion" and two Tables. Table I contains a tabulation of the important factors responsible for the large losses and Table II is a record of the large fires divided by occupancies (giving cross references to individual reports on particular fires reported).

Acknowledgment

The study is based on reports submitted by many individuals and agencies. The fire reports so submitted are in many cases the result of extra time and effort. They often include special drawings, plans and photographs. They may be the result of hours of investigation and writing. It is to these people — the fire chiefs, the fire marshals, the inspectors, the insurance industry and the NFPA members who have given of their time that this large loss story is dedicated, for without their support and interest there would be no story.

*See NFPA list of "Publications on Fire Prevention and Protection" for data on these Records.

1958 Large Loss Building Fires —

Cause of Fire

In two-thirds of the 286 building fires, known or probable causes were reported.

Electric Wiring

Of the 191 known or probable causes there were 41 (21.4%) attributed to wiring or lighting faults. This has been the leading cause of the large loss fires for two consecutive years (28 reported in 1957). See page 243 for fires caused by electrical appliances.

June 4, near Orange, Texas, Orange County Navigation Port District $435,000

WAREHOUSE, WHARF. This 90 ft. by 674 ft., 1-story metalclad, wood-joisted canal-side shipping warehouse was divided into five sections by 12-inch-thick brick division walls. These walls extended from the front to the back of the warehouse and 6 feet through the roof, but they were not winged or tee'd, and did not extend under the creosoted wood timber wharf which ran along the canal side of the warehouse.

Private fire protection consisted of water supplied through 6,500 feet of 6-inch cast-iron main to seven hydrants on the land side of the building and to nine 2½-inch pipe outlets on the water and wharf side of the building, each outlet having 50 feet of 1½ inch hose attached. This 50 pound static pressure water system could supply only 200 gpm at 20 pounds residual pressure. Four 8-inch pumper suction lines were available for emergency use, running from the canal to the land side of the building.

The property was undergoing renovation and most of the hydrants and the outlets for the suction lines were blocked by loads of gravel or parked construction equipment.

Sometime after 4 P.M. the electric wiring in one of the warehouse sections shorted, causing a fire. Smoke was seen seeping under the eaves of the building by one of the port guard force. He and some of the construction workers attacked the fire with hose lines. Finally at 4:39 P.M. an unknown person pulled the fire alarm box on the premises. The responding fire equipment was delayed getting into action by the blocked suction outlets. The fire spread 105 feet to one of the brick fire walls. Flames almost succeeded in burning around the wall under the wharf, but two tugboats with pumps arrived and by using hose streams from the tugs the fire was stopped at this point. Flames also spread in the opposite direction 180 feet to another fire wall. Due to the lack of other water-based craft, it was not possible to check the spread here and the

Clearwater Fire Department

Short circuit of wiring in the vicinity of a fuse box was the probable cause of fire that destroyed this multiple occupancy store building and supermarket at Clearwater, Florida, March 17.

Wide World

Defective wiring in the laundry area was the cause of this $301,500 apartment house fire at International Falls, Minn., March 10. The laundry was the only part of the building not rewired a year earlier.

fire, skirting the fire wall by spreading under the wharf, destroyed the remaining 95 feet of the warehouse.

Improperly designed fire walls, inadequate, obstructed water supplies, delayed alarm and the lack of automatic sprinklers contributed to the seriousness of this fire.

June 26, Duarte, Calif., H & M Banana Co. $260,000

BANANA PACKING PLANT. A paper shredding machine was located next to an open freight elevator in the basement of this 85 ft. by 150 ft. 1-story stuccoclad, wood-framed banana packing plant. As an employee was shredding paper about 9:30 A.M., he saw flames jump up from the shredded paper lying on an electrical cord to the machine. After a vain attempt to move the burning paper away he fled as the fire leaped up an open elevator shaft to the first floor. It spread so fast that office employees on the first floor were unable to call the fire department and fled, too, leaving the vault door open.

The heat from this fire ignited trees over 50 feet away. The company records, insurance policies and bills receivable were destroyed.

While an electrical defect was the basic cause, the fact that the special hazard paper shredder was not cut off from the rest of the building by fire-resistive partitions, that the stairway and elevator shaft were open, and that the combustible building was unsprinklered were major contributing factors to fire spread.

July 9, Quebec, P.Q., Terreau & Racine, Ltd. $507,000

RETAIL STORE AND WAREHOUSE. Fire on the top floor of this unsprinklered 6-story and basement brick, steel-framed retail store was discovered by the night watchman about 7:10 P.M. He had found nothing unusual on his 6 P.M. round but apparently a light bulb in contact with a mattress ignited the latter during the hour interval. A new stock of mattresses had been piled so high that the bulb was found in contact with a mattress. Though the fire department was able to confine the smoky fire to the sixth floor storage area, water from hose streams leaking to lower floors caused severe contents damage.

Suspicious or Incendiary

Number two spot on the list of fire causes is the suspicious or incendiary fire which was reported 24 times (12.5%). This cause of fire has held the second position for two years after being deposed from the number one spot in 1956 (19 in 1957, 21 in 1956).

May 13, Lincolnwood, Ill., Allgauer's Fireside Restaurant $600,000

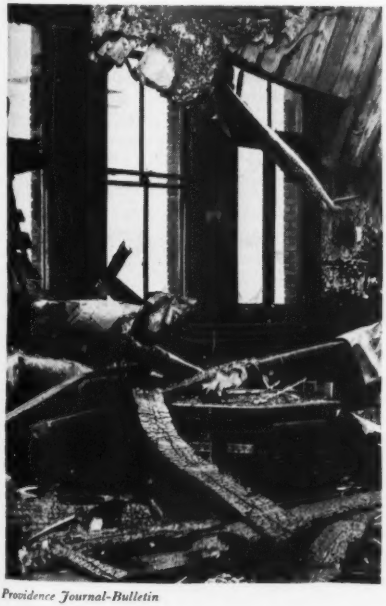
RESTAURANT. Two rubber masked thugs hid in a rest room of this 150 ft. by 150 ft., 2-story basement and attic brick, wood-joisted popular restaurant until after it had closed. They then held the remaining people in a washroom at gun point while they ransacked the restaurant records, and soaked the building with gasoline. Releasing the hostages, they ignited the gasoline with matches and disappeared.

The fire spread rapidly and burned persistently until the building was completely destroyed. It is thought that the burning was an attempt to warn restaurant owners against testifying before Senate Investigating Committees.

Ketchikan Volunteer Fire Department

Flammable liquid was used to start fires in four sections of this storage building (formerly a salmon cannery) at Ketchikan, Alaska on Oct. 3.

July 25, Providence, R. I., Providence Public School Administration Office $800,000



Providence Journal-Bulletin

SCHOOL OFFICES. A 26-year-old man confessed to throwing gasoline around a third floor room, igniting it and leaving the building. As the 115 ft. by 187 ft. 4-story brick, wood-joisted school office building was sprinklered only in the hallways and as the watchman had five separate buildings to cover, the fire was not discovered until it was visible to outsiders who pulled a nearby street fire alarm box at 7:59 P.M.

The fire entered a concealed ceiling space and spread out of range of hose streams to destroy the top two floors and roof of the building. Seventy-five hallway sprinklers opened but were unable to reach the fire in the unsprinklered areas and were overpowered.

Sept. 2, Oshawa, Ont., F. W. Woolworth Co. Ltd., et al. $250,000

5¢ TO $1 STORES. An 18-year-old female employee is reported to have used a cigarette lighter to ignite a pile of paper and cellophane bags in the basement of this 63 ft. by 177 ft. 2-story brick, wood-joisted "Five and Ten." Feeding on paint, turpentine, plastic products and wooden storage bins, the fire generated a large amount of smoke.

The assistant manager did not use the street fire alarm box until after an attempt to use the telephone, unsuccessful because of burned wires. Evacuation of patrons was rapid but orderly. The fire in the unsprinklered basement gradually spread through the rest of the building. Smoke damaged 14 surrounding properties.

Heating and Cooking Equipment

Position three on the list of fire causes has been taken over by the 16 fires (8.4%) attributed to defective or overheated heating and cooking equipment. Last year this cause held sixth place with 10 fires.

Jan. 8, Union S. C., Tabernacle Baptist Church $250,000

CHURCH. A coal burning furnace in the center basement section of this thrice expanded 35 ft. by 233 ft. 1- and 3-story brick veneered, wood-framed church was not enclosed in a fire-resistive furnace room, and there was no automatic sprinkler system or central-station-supervised automatic fire alarm. It is believed that the furnace overheated, igniting the rafters overhead.

The fire was able to spread throughout the undivided basement before it was discovered by police in a cruiser about 2:30 A.M. A radio call from the cruiser brought the fire department, but by then the fire was in the nonfirestopped walls where it spread unmolested until the entire church was destroyed.

March 7, Detroit, Mich., Great Scott Super Market $294,000

SUPERMARKET. A vent pipe from a gas-fired space heater passed through a combustible fiberboard ceiling, a 5 foot concealed ceiling space and a plank-on-steel truss roof.

A night stock man, locked in the building at closing time as a usual practice, was under orders to report any difficulties to the manager by phone. A peripheral burglar alarm was set each night at closing time.

During the early morning hours of March 7, the vent pipe overheated and ignited the combustible fiberboard ceiling. The night porter saw it almost immediately and called the night manager who instructed him to call the fire department. Before he could dial the fire department number, the fiberboard ceiling was heavily involved forcing him to seek escape. Providentially a small explosion blew out the plate glass front windows allowing him to escape as the burglar alarm was transmitted to a central station alarm office. Responding on the burglar alarm, police radioed the fire alarm to the fire department. While the cause was improper installation of the vent pipe, the lack of sprinklers, the combustible fiberboard ceiling and the delayed alarm combined to permit the fire to completely destroy the building. Locking a man into such a building is a matter which needs no comment.

Dec. 18, East Gwillimbury Twp., Ont., Federal Farms Ltd. $500,000

VEGETABLE PROCESSING. An oil-fired salamander was used to heat a railroad car on the track adjoining this 60 ft. by 300 ft. 1- and 2-story concrete block, wood- and steel-

Union Daily Times

Ignition of wooden floor joists in the not-cut-off furnace room by an overheated furnace was the cause of this church fire at Union, S. C. See detailed report on this page.

Charles Reich

Overheating of the vent from a charcoal broiler ignited the combustible fiberboard ceiling of this swanky restaurant near Knoxville, Tenn. The fire in the ceiling was supposedly extinguished so the fire department was not called. When reignition occurred the extinguisher was empty. The fire department was 6 miles away. See detailed report on page 305.

joisted, food processing plant. After the car had been heated, the salamander was shut off and removed to the enclosed shipping platform. For an unexplained reason the salamander was tipped over. The warm oil flowed over the platform and into the building where it ignited. The plant had no organized fire brigade, but three dry chemical extinguishers were used without success.

Flames spread easily up an open stairway and throughout the undivided building. As no public or private water supply was available for fire fighting, the building and its contents, including LP Gas-fueled lift trucks, were destroyed.

Smoking and Matches

Fourth position on the list of known or probable causes of fire is held jointly by smoking and matches, welding and cutting. It is interesting to note that of the 15 smoking and matches fires (7.7%) six were in mercantile occupancies, three in warehouses and six in other types of buildings. Smoking and matches was seventh on the 1957 list of large losses with only 8 fires although this cause leads all others in the total U. S. building fire experience.

April 3, Amarillo, Texas, Blackman Bros., Inc., et al. $1,175,000†

CLOTHING STORES. Two teen-agers had been trying on expensive ladies' dresses alone in the swank French room on the second floor when they came running out announcing a fire. The store employees tried unsuccessfully to put out the fire with 1-quart carbon tetrachloride extinguishers. Ten minutes elapsed before this unsuccessful attempt was abandoned and the delayed alarm was telephoned to the fire department.

The fire started to spread through the second floor of this 12,585 sq. ft. 2-story and basement brick, bar-joist store. The steel columns were protected with 1½-inch-thick metal lath and plaster while the metal roof deck was protected with a suspended ¾-inch-thick metal lath and plaster fire barrier ceiling. Unfortunately this fire barrier was pierced by recessed light fixtures and the fire spread through these unprotected openings into the concealed ceiling area. The heat melted the asphalt vapor barrier on the roof deck assembly and the asphalt vapors, penetrating through the metal deck joints, ignited, further spreading the fire in the concealed space out of reach of hose streams.

A careless smoker is believed responsible for the blaze. The lack of automatic sprin-

†Includes business interruption loss.

klers and an incomplete ceiling were the main reasons for the heavy direct and indirect losses. (See page 224, January 1953 QUARTERLY for a report of a $863,000 fire in this same unsprinklered store.)

July 6, Amherst, N. S., Maritime Winter Fair & Bailey Arena $633,000

EXHIBITION HALL AND HOCKEY ARENA. A cigarette is believed to have started a fire under an unloading platform of this 75 ft. by 925 ft. vacant fair building. As the fire was hidden by railroad cars on the adjacent rail siding, it was not detected until visible at a distance.

Lack of a fire wall between the arena and the exhibition hall, and the delayed alarm, combined with the fact that many of the volunteer fire fighters take summer Sunday mornings to go to the shore, resulted in destruction of 600 feet of the building, the arena, and the ice-making equipment.

Welding and Cutting

The other cause tying for fourth place is the welding and cutting fire (7.7%). For the second year it has held this same position (13 in 1957, 15 in 1958).

Feb. 1, Elnora, Ind., Elnora Paper Converters, Inc. $299,000

MANUFACTURER OF GLUED PAPER TAPE. An acetylene cutting torch was being used by a Saturday morning maintenance crew inside a drier in this unsprinklered 17,000 sq. ft. 1-story concrete block, wood-joisted gummed paper tape factory. The heat of the torch ignited the combustible insulation of the drier which burned rapidly. The maintenance men attempted to fight the fire with a carbon dioxide fire extinguisher, unsuited for this type of fire, before giving the alarm.

A chief and six volunteer firemen responded after 10 minutes with one 500 gpm pumper. An hour later the town's second pumper was brought to the scene by a fire fighter sent for it, and a half hour later help from a nearby town was called. A considerable quantity of raw stock (rolled paper) was destroyed along with the building.

April 12, Monrovia, Calif., Chem-Therm Mfg. Co., Inc., et al. $357,500†

STEAM CLEANERS AND CAR WASH EQUIPMENT MANUFACTURERS. A part-time employee was using an arc welder to attach a trailer hitch to his father's car. This Saturday afternoon project ended when the

†Includes business interruption loss.

Ronald Arvin

A maintenance crew accidentally started the fire with an acetylene torch at Elnora, Ind. The fire originated in combustible insulation on a drier. See detailed report on this page.

arc struck on the car's gasoline tank, puncturing the tank and igniting the gasoline.

The employee attempted to back the flaming car out of the 19,500 sq. ft. 1-story wooden building but was driven back by the rapid spreading fire. The alarm was telephoned by an employee of a neighboring

Monrovia Fire Department

plant. As the hose lines were being laid, two acetylene tanks exploded while the three remaining acetylene tanks released their contents through the fusible plugs as designed. The reason for the failure of the two tanks has not been determined, but it is obvious that the fusible safety relief devices did not prevent their rupture.

The released gasoline and acetylene combined to involve the building extensively before fire fighting could be started. Some office records were recovered.

May 13, Oshkosh, Wisc., Commodity Storage Corp. $322,000

BUILDING UNDER RENOVATION. This windowless building was originally used to store blocks of wood from which match sticks were made. It had changed hands recently and was being converted to a grain storage warehouse. The 60 ft. by 300 ft., 70-ft.-high reinforced concrete-walled building was having wooden bins installed. The complete sprinkler system for the building had been shut off five months before.

Welders at work inside were thought to have ignited the wooden scrap from the bin construction. The blaze burned unnoticed until spotted by an off-duty fireman about 2:46 A.M. The windowless walls made fire fighting extremely difficult and the building was destroyed.

Electrical Appliances

Fire caused by electrical power consuming appliance failures remained in the fifth position for the second year, with 11 in 1957, 12 (6.3%) in 1958. Electrical wiring fires were reported on page 237.

May 9, Galesburg, Ill., Galesburg Public Library $650,000

PUBLIC LIBRARY. The destruction of 122,000 books, historical Illinois documents and letters of Abraham Lincoln was the result of a fire in this unsprinklered 66 ft. by 132 ft., 3-story stone-faced brick, wood-joisted public library. Originating in the open undivided attic at an exhaust fan motor that had been giving trouble for some time, the fire burned undiscovered until occupants smelled smoke and telephoned the alarm at 7:32 P.M.

Even though fire fighters responded at once, an effective attack was prevented due to the difficulty in supplying water. The town's already weak water system was at a dangerous low because two of its direct discharge pumps were being repaired. The system at the time of the fire was capable only of supplying 300 gpm.

Sept. 28, Boise, Idaho, Gem State Wholesale Drug Co. $415,500

CHEMICAL AND DRUG WAREHOUSE. When an electric motor burned out and ignited stock in the basement of this unsprinklered 35 ft. by 125 ft., 3-story and basement brick, wood-joisted wholesale drug warehouse, there was no notification of fire. The Sunday morning fire in the unprotected basement burned until it triggered the burglar alarm. Responding police radioed the alarm.

Fire fighters found that the fire was already spreading up an open elevator shaft and open interior stairway. Light smoke and water damage was experienced in both adjoining properties. Office records in safes were recovered intact as the fire was kept out of the office located on the first floor.

Flammable Liquids

Dropping from third place to sixth were the 11 fires (5.8%) caused by the misuse of flammable liquids. In 1957 there were 14.

April 9, Barberton, Ohio, Alside Aluminum Co. $2,040,000†

ALUMINUM SIDING FABRICATION. While the fuel tank on a large truck was being filled at a gasoline pump adjacent to the building, the automatic nozzle on the dispensing hose failed to shut off. At the time, the employee doing the fueling was answering a telephone in a small shed abutting the factory about 20 feet away. When he returned he discovered the fuel tank overflowing and between 30 and 40 gallons of gasoline on the ground. The vapors ignited explosively at a gas heater in the shed. Fire involved the shed and entered the attached, unsprinklered 200 ft. by 1,000 ft. 1-story masonry, steel-framed factory through plain glass windows broken by the explosion.

With no sprinklers or division walls, flames spread throughout the building and a combustible vapor barrier in the steel roof deck assembly melted and burning asphalt vapors penetrated into the building. A dead-end 4-inch water main at the factory did not supply enough water to be very effective and forced the fire fighters to regroup and then wage a holding battle on the last third of the building with water relayed about 800 feet from a dead-end 8-inch main.

†Includes business interruption loss.

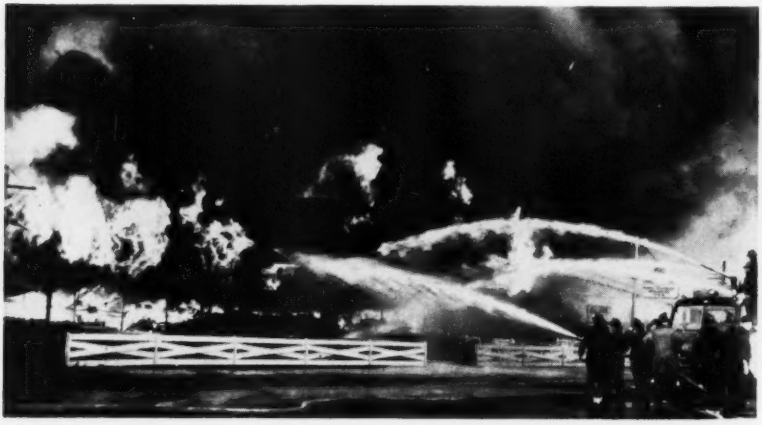
***Jan. 20, Cleveland, Ohio, Fountain Specialties Co., et al. $332,500.†**

SODA FOUNTAIN SIRUPS; RADIO EQUIPMENT MANUFACTURING. An employee used gasoline to clean a multigraph machine. The gasoline vapors spread until they reached a gas heater which ignited them. The resulting explosion and fire burned the telephone wires so that the office manager, who had removed the employee's burning clothes, was unable to reach the fire department until he found an operating phone in a nearby office. Four employees were injured.

The ensuing fire quickly spread throughout the open unsprinklered 98 ft. by 141 ft., 1-story brick, wood-joisted building and then flames burst from the rear windows and ignited six exposed wooden dwellings.

Ironically, the fire destroyed a municipal radio fire alert system that had just been completed by the Royal Communication Systems, Inc., which shared the building.

*Fire spread to other buildings.



Wide World

This building materials warehouse fire at Chicago, Ill., July 2, was one of four large loss fires in 1958 attributed to lightning.

1958 Large Loss Building Fires —

Time, Place and Origin of Fire

Time of origin has an influence on the large loss experience. A recent review of fire department annual reports shows that 58 per cent of the alarms occur between the hours of 6 A.M. and 6 P.M. and 42 per cent for the other 12 hours. The study of large loss fires reverses this percentage with 59 per cent occurring in the 6 P.M. to 6 A.M. period.

The lightest period for fire department alarms was between the hours of 3 A.M. and 6 A.M. when only 4.4 per cent of the alarms were received. Conversely the 3 A.M. to 6 A.M. period was the heaviest for large loss fires, as 17.6 per cent of the fires were discovered then.

These reversals show clearly the influence of delayed discovery (see pages 249 to 256) and occasionally the effect of nefarious nighttime operations, such as burglary.

***July 5, near Portland, Ore., Signal Fireworks and Specialty Co., Inc., et al. $250,000; 1 killed**

FIREWORKS WAREHOUSE, DWELLINGS, ETC. Night fires are sometimes caused by burglars as in this case. July 4th had passed less than two hours when a young man broke into this 66 ft. by 68 ft. 1-story main fireworks warehouse of mixed construction and accidentally set fire to the building while attempting to steal money. The fireworks started to go off as he fled. The sky was briefly lit by a display before the rest of the twenty tons of fireworks exploded in two bomb-like bursts.

The 1:40 A.M. blast and ensuing fire not only leveled the main warehouse and the 40 ft. by 68 ft. 1-story rear warehouse, but also destroyed two dwellings, a garage and two automobiles. A young girl was burned

*Fire spread to other buildings.

Finley's Camera Supply

One of the 50 large loss building fires to be discovered between 3 A.M. and 6 A.M. destroyed this pottery manufacturing plant at Compton, Calif. The fire was out of control in the sprawling unsprinklered combustible building when first noticed by the watchman of a neighboring plant.

to death in one of the dwellings. Twenty-six persons were injured. Over 200 other buildings suffered damage, ranging from major structural damage to single broken windows and mirrors. Most of this damage was confined to an eight block area centered by the warehouse. The preplanned fire and emergency equipment response was large enough to enable practically simultaneous extinguishment of the fire and handling of wounded survivors.

Nov. 9, Jefferson, Texas, Jefferson High School $275,000

HIGH SCHOOL. About 5:50 A.M. a passer-by happened to notice flames burning inside this 60 ft. by 270 ft. 2-story brick, wood-joisted high school. As there were no automatic sprinklers or automatic detection system, the fire had burned an estimated 3 hours before chance discovery by the passerby.

The responding fire department was faced with collapsing roofs on arrival, and as there were no fire walls to subdivide the building it was completely destroyed.

Place

Large loss fires can occur wherever a value of $250,000 is subject to one fire. As long as such values are left unprotected and exposed, there will be large loss fires.

The physical size of the town involved, its population and its total wealth seem to have little to do with the large loss experience. The factor that appears to be important is the frequency with which large values, without adequate fire protection, are exposed. (See article on "Private Fire Protection" pages 289 to 306.)

June 29, Los Angeles County, Calif., Radio Corp. of America $577,000

RADIO AND T.V. SETS, PARTS WAREHOUSE. Here is a large loss fire in an area with one of the most modern, best equipped and fully trained fire departments in the world. Since

Duane M. Scheel

Fire in this foundry in Salem Township, Mich., broke out at 2 P.M. August 5 while the plant was in full operation. The building was one of several suffering large loss fires that had no private fire protection and was located in a small town. On discovering the fire employees called the fire department and then carried company records to safety.

Wide World

Originating between the first and second stories in an unused elevator shaft, fire spread up the shaft and mushroomed through the top two stories of this unsprinklered 5-story office building in Cincinnati, Ohio on January 2.

there were no automatic sprinklers, detection or watchman service, this fire burned for an estimated six hours before discovery. The fire started in the repair shop of this 90 ft. by 130 ft. 1-story brick, wood-joisted warehouse. Before discovery at 5:18 A.M. it had spread throughout the rear portion of the building and was through the roof.

April 28, near Ogallala, Neb., Cater Construction Co. $250,000

MOTORIZED CONSTRUCTION MACHINERY STORAGE. Here is a large loss fire outside of a town with a population of 3,440 persons. A determined volunteer fire department, equipped with one pumper, protects the area

The fire burned for an undetermined period of time before it was discovered by an employee of a nearby firm about 9 A.M. The fire department was hampered by lack of water. As water in the town's pumper was used up, it was replaced by water carried to the fire by the town's street sprinkler tank truck. Efforts to halt the advanced fire were futile. A large amount of heavy motorized contracting equipment was destroyed.

Origin

One hundred and seventy-four large loss fires occurred in multistoried buildings. Seventy-two of these were in multistoried buildings without basements, 102 in multistoried buildings with basements. The remaining 112 large loss fires occurred in 1-story buildings, only 14 of which had basements.

Floor of Origin

One hundred and sixty-two large loss fires started on the ground floor, 53 in basements, 41 on the upper floors, 9 in spaces under the building, 5 in the attic, 3 on the roof and 3 fires spread inside from the outside. The remainder started in unknown areas of the buildings. For information on how these fires spread see pages 263 to 288.

Jan. 25, near Toledo, O., W. T. Grant Co., et al. $752,000†

SHOPPING CENTER. A property value of less than $11 per sq. ft. was involved in a fire which destroyed this 48,600 sq. ft. 1-story noncombustible variety store. The maintenance man for the shopping center passed this group of buildings about midnight and saw nothing wrong. At 12:25 A.M. two employees from a nearby grocery store noted flames in one corner of the single story sales area, and telephoned the alarm.

Heat broke the plain glass in the front and the rear of the store. Because of a 25 mile an hour wind the flames spread rapidly. The open store was totally involved on the arrival of the fire department. The long-span bar-joists were so warped by the heat that the roof started to collapse as fire fighting began. The fire spread was kept within the store of origin by a parapeted hollow concrete block partition which included a standard fire door assembly. There was no sprinkler system, no fire alarm system, no watchman service, nor standard fire wall within this large store.

†Includes business interruption loss.

April 6, Swarthmore, Pa., Swarthmore-Rutledge-Union School District $450,000

HIGH SCHOOL. An upper floor fire heavily damaged this 2½-story and basement high school. The Sunday evening fire was thought to have been set by unknown persons after they burglarized the school.

The building was of stone, wood-joist construction but was not sprinklered. The fire was started in a second story chemical supply room. Spreading upwards through a trap door to the wood-joisted, wood-covered attic, the fire burned unnoticed until a passerby saw flames coming through a louvered vent on the roof. This passerby called the fire department, which in turn called mutual aid forces. The building standpipe and hose system was put in service by the fire department, but the water pressure dropped due to outside hose streams. As no fire department connection had been provided for this hose system, it had to be abandoned. The fire was confined to the attic area.

Oct. 15, off Louisiana Coast, Continental Oil Co., et al. $1,146,500; 7 killed

OFFSHORE WELL DRILLING PLATFORM. A property-value of approximately $125 per square foot was involved in the explosion of this one-story and platform drilling rig on a Wednesday afternoon. The cause of the explosion has not been determined. It is known that 7 of the 29 men on the offshore drilling platform were killed and 21 were injured. Evidently an explosion on or under the elevated structure ignited most, if not all of the platform's seven wells, causing the ensuing fire.

By the end of a week only two wells were still burning. Three mobile platforms were brought in. Wells were drilled from these mobile platforms to divert gas from the fire at the drilling rig, after which the fire was extinguished.

Fire control operations cost an additional $2,022,500.

1958 Large Loss Building Fires —

Detection of Fire

Detection is the first step in any fire control operation. Detection can occur in a variety of ways, but in order for the alarm to be given someone or something must detect the fire. Ideally detection should occur simultaneously with ignition of the fire.

Of the 286 large loss building fires, 32.5 per cent (93) were detected immediately. Delayed detection was a factor in the remaining 67.5 per cent (193).

Detection Record

The initial detection of the fire was made in 110 cases by outsiders or passers-by, in 103 by occupants or employees, in 24 by watchmen, in 18 by police, in 16 by an explosion, in 6 by automatic fire alarm equipment, in 3 by burglar alarm equipment, and in 2 by automatic sprinkler equipment. In the remaining 4 fires, detection was made by miscellaneous means.

April 23, Chattanooga, Tenn., M. M. Hedges Mfg. Co. $460,000†

Gas and Electric Water Heater Manufacturer. Originating in diesel oil that had accumulated in a ditch beside a railroad siding, fire ignited a wooden loading platform on the 23,000 sq. ft. 1-story brick, wood-joisted building. Flames entered the unsprinklered section of the building, apparently through loading door openings, and spread within the building before strong winds. The fire was discovered immediately and the alarm given instantly by the central-station-supervised fire alarm installed in the unsprinklered section.

The responding fire fighters found there were problems in fighting this fire. Several firemen were injured by explosions when hose streams struck a burning pile of 5,000 bars of magnesium stored in the building. Burns

†Includes business interruption loss.

George Baker

Although delayed discovery is usually an important contributing factor in large loss fires, there are instances, such as the metalworking plant fire at Chattanooga, Tenn., (see report, this page) where fire spread beyond control despite prompt detection.

Allen Photographic Studio

Fire broke out on the shipping platform of the furnace factory at Wilmington, Ohio, while employees were still in the building but was not discovered until seen by outsiders (see report, this page). Manufacturing was permanently discontinued because of the fire.

were also inflicted on firemen by molten metal when a hose stream was turned into a kettle of molten zinc alloy by mistake.

A masonry wall with protected openings kept fire from the adjoining sprinklered section until flames broke from the roof and jumped the parapet. Fourteen sprinklers operating beneath the roof kept the fire from entering the sprinklered area while the roof fire was extinguished with hose streams.

This fire was not the first to have occurred in the drainage ditch, and the president of the water heater company told a newspaper reporter that his company had made protests to the railroad company about the oil seepage.

Operating Status

Of the 286 large loss building fires in 1958, 176 occurred when the building was not occupied or occupied only by watchmen or guards. Discovery was delayed in 88.1 per cent (155) of the fires in these buildings. Seventy-two fires occurred in buildings which were fully occupied (shifts working, classrooms full, etc.), and discovery was delayed in 23.6 per cent (17) of these. Thirty-five buildings were occupied partially (maintenance crew or office staff on hand), and in 54.4 per cent (19) discovery was delayed. Two of the 3 remaining buildings were idle or vacant (not in use at all), and the status of one building is unknown. Delayed discovery occurred in 2 out of these 3.

Feb. 27, Wilmington, Ohio, Farquar Furnace Co. $301,000

HOT AIR FURNACE MANUFACTURE. This unsprinklered, 25,000 sq. ft. plant closed for the day at 4 P.M. but five office workers remained. The concrete block, wood-joisted building consisted of a large 1-story manufacturing section and an attached 2-story office section. A passerby saw fire coming out of the plant shipping department and called the fire department at 4:29 P.M. The office workers were unaware of the fire until the apparatus arrived.

As most of the plant was undivided by fire walls, there was nothing to slow fire spread. It is interesting to note, however, that the plant painting department was saved since it was constructed of fire-resistive material and protected by automatic closing fire doors.

Fire fighting was complicated due to the fact that the nearest fire hydrant had been damaged some time before the fire. Other hydrants 600 to 800 feet away were used but until mutual aid companies arrived there was not enough hose to reach the rear of the building. Office records were saved by removal from the building before the fire spread to the office section.

Lack of Detection Means

The lack of private fire protection of the type designed to assure prompt fire detection was by far the largest factor in the delayed discovery of fire. In 78.2 per cent (151) of the 193 cases of delayed discovery, there was no private detection system in the form of automatic sprinkler systems, automatic detection equipment, or watchmen.

***Feb. 4, Joliette, P. Q., Louis Desrochers and Sons, et al. $748,500**

Wide World

HARDWARE STORE, HOTEL, 3 DWELLINGS. A fire had been burning on the first floor of this 48 ft. by 211 ft. brick, wood-joisted hardware store for some time. A constable on night patrol discovered the fire about 3:15 A.M. and immediately pulled the street fire alarm box.

The fire department responded with two pumpers and requested another from Montreal, 45 miles distant. The reinforcing pump arrived at 7:30 A.M. in time to help wet down the ruins of the store, a hotel, three dwellings.

*Fire spread to other buildings.

Watchman

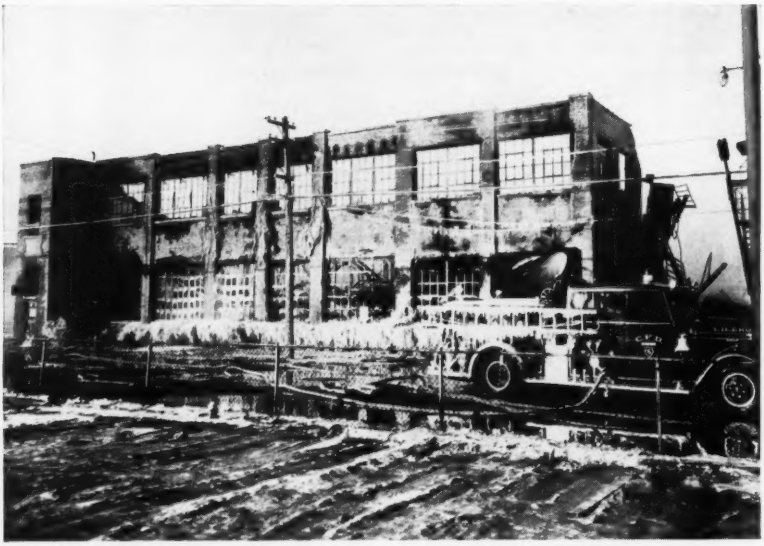
There were 53 large loss fires that occurred in buildings having watchman service. In 6 of these cases the service was satisfactory since the watchman discovered the fire and transmitted the alarm with no delay. In 14 fires the watchman service was not a factor as the fire was discovered promptly by other means, such as by occupants (10), by an explosion (2), by automatic detection equipment (1) or by an outsider (1).

In 33 fires the watchman service did not function effectively to provide prompt detection. In 18 of these cases the watchman did discover the fire, but not until after an appreciable delay, while the remaining 15 were not discovered by the watchmen on duty. The reasons for this experience are as follows: in 7 cases the fires broke out between rounds (although in 6 of these 7 there was standard hourly service); in 6, the watchman patrolled only on the outside of the buildings he served; in 6, the patrolled area was judged too large for one man to cover effectively; in 5 the watchman had other duties which detracted from his primary responsibility; in 3, the fire occurred after the watchman had reported for duty but before he started his rounds; in 2, the watchman was asleep at the time fire was discovered by others. In one instance each: the watchman gave irregular service; stepped out for a few minutes; fought the fire, delaying the alarm; or the fire occurred in a concealed space where it wasn't noticeable until it broke into the open.

***Feb. 13, Cicero, Ill., Strom Steel Ball Co., et al. $3,450,000†**

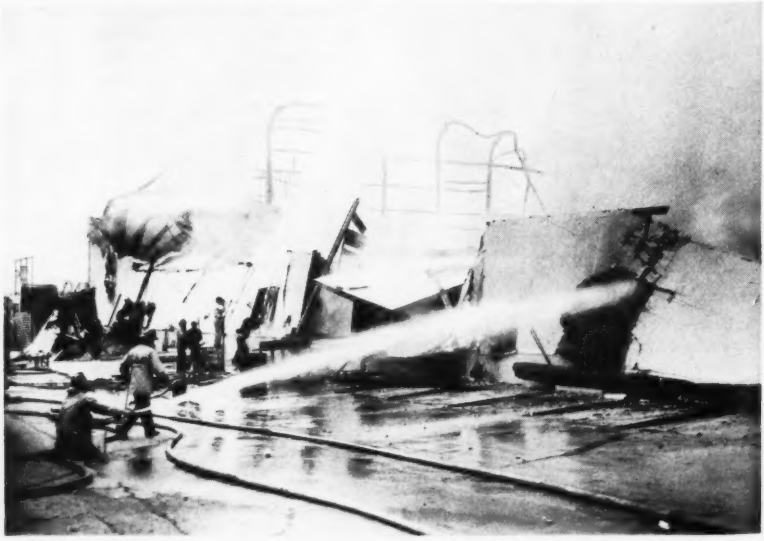
PRECISION METAL BALL MANUFACTURERS. The original 100 ft. by 300 ft. 1-story brick, wood-joisted, metal ball manufacturing plant was expanded by adding a second

†Includes business interruption loss.



Hurley of Brookfield

The watchman closed the fire pump discharge valve at this Cicero, Ill., steel fabricating plant soon after fire broke out. This action resulted in the largest building fire loss of the year. See report on preceding page.



Citizen-News

About 30 minutes after a supervised watchman made an hourly tour of this Los Angeles, Calif., motion picture studio, fire was seen coming through the roof of the unsprinklered combustible structure. See report on next page.

story. This expansion (done some years ago) required the installation of reinforcing beams to support the original roof as it was not capable of supporting the machinery load it would have to carry when it became the second floor. The concealed spaces formed by these extra floor supports were sprinklered as was the remainder of the building. The sprinkler water supply was bolstered by an automatically-operated 750 gpm fire pump mounted on a separate connection to the 8-inch, 35 pound static, street supply.

The fire originated in the concealed space described above and set off a sprinkler head. This rang the sprinkler alarm bell. The night watchman quickly located the fire and telephoned the fire department immediately. Fire fighters, responding promptly on this bitterly cold night, started to lay hose. In the meantime the watchman in his confusion, and due to his poor training, shut the automatic pump discharge valve and opened the sprinkler riser drain valve, depriving the sprinklers of the fire pump discharge and further weakening the inadequate city supply. The fire department failed to connect to the sprinkler fire department connection. The fire spread steadily over the oily deposits throughout the building. It destroyed the building and spread to a nearby rubber company which was heavily damaged. It also spread to a nearby electronics firm which was spared heavy building damage by its interior sprinkler system. The sprinklers in the electronics building opened, cooling the interior of the building and preventing its ignition.

Strom Steel Ball had employed 300 people up to the time of the fire. Both the Strom Steel Ball and the rubber company suffered heavy company record losses.

July 2, Los Angeles, Calif., Samuel Goldwyn Productions, Inc. $1,130,000

MOTION PICTURE STUDIO SOUND STAGE. The second largest sound stage in the world was a 1-story, 132 ft. by 225 ft. stucco-on-wood-framed building. Its dome-shaped plank-on-steel-truss roof was 65 ft. off the lapped, 2-inch-thick, plank-on-joist floor. The basement, like the first floor, had no cutoffs or draft stops. The building was unsprinklered and had no automatic alarm system.

The building was a historical one for its type as it was the scene of pictures starring Mary Pickford, Charlie Chaplin, John Barrymore and other movie actors. The basement was used for storage of sets from past pictures, furniture, and original recordings of the early sound pictures. The first floor contained a set that was only hours old. It was to be used when shooting "Porgy and Bess" scheduled to start later in the morning.

A studio watchman making standard hourly rounds on a supervised watchman's tour checked the building about 3:32 A.M. and noted nothing unusual. Shortly after 4 A.M. the watchman saw flames coming through the roof of the stage building while still making his rounds in other sections of the movie lot. He pulled a nearby central station supervised fire alarm box immediately. The fire companies began to arrive within minutes, but the building was already totally involved.

Automatic Detection Equipment

Automatic detection equipment was installed in 7 of the properties included in the 1958 large loss building fires record. Six of these were central-station-supervised. The seventh was a local alarm system. In only one of these 7 fires was detection delayed. This delay was due to the fire's originating above the roof of a building, out of range of the central-station-supervised detection equipment within the building.*

In the remaining 6 cases detection and alarm were prompt, yet large loss fires occurred due to the lack of automatic extinguishing equipment, the burning characteristics of the contents or structural weaknesses in the properties.†

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*This case (Tacoma, Wash.) is summarized on page 257 of this issue of the QUARTERLY.

†Three of these six fires are summarized in this issue of the QUARTERLY. Chattanooga, Tenn. page 249, Savannah, Ga., page 255, Loretto, Pa., page 258.

News-Press

Fire that apparently was discovered promptly by a central-station-supervised automatic rate-of-rise type fire alarm system spread out of control in this Savannah, Ga., department store before hose streams were in operation due to lack of sprinklers and the presence of an open elevator shaft. The few customers in the store all escaped safely. Flames were visible on all floors when the firefighters arrived. **See report on next page.**

May 20, Savannah, Ga., Leopold Adler Company, et al. $844,000

DEPARTMENT STORE. A fire originated near the open freight elevator shaft in the basement of this 60 ft. by 90 ft. 4-story brick, wood-joisted store building. This building adjoined a similarly constructed 90 ft. by 120 ft. 4-story sprinklered building which made up the rest of the store. The sprinklered section was separated from the unsprinklered section of origin by a fire wall with standard automatic closing fire doors on both sides of the wall. The unsprinklered building was protected by a central station supervised automatic fire alarm system.

Unfortunately the precautions of having automatic fire doors and a good fire alarm system were not followed through by providing enclosure for the freight elevator shaft.

The building had been open for business for about one hour but due to rain showers there were few customers in the store at the time the fire broke out. The fire was detected (10:35 A.M.) by the rate of rise alarm system, and the alarm was transmitted from the central station immediately to the fire department. The fire, however, was able to spread to all upper floors through the open shaft and flames were visible on all floors when the fire department arrived. The automatic fire doors operated quickly on the exposed side of the fire wall so that fire fighters were able to go around closing the doors on the unexposed side. Only 3 sprinklers operated in the protected section of the store.

When the end wall of the burning building collapsed, it destroyed another adjoining 2-story brick, wood-joisted building, by collapsing the roof and second floor.

A fire of this magnitude during the middle of a weekday morning in a fire alarm equipped, occupied, building located in the business district of a large city is unusual. The effect of the open elevator shaft on speed of the operation of the rate of rise fire alarm system is not known for certain, but obviously the shaft affected the fire spread significantly since combustible stock ignited on each floor before the fire department could travel 5 blocks.

Wide World

Five wooden buildings were destroyed and three were badly damaged by fire that originated in a summer hotel at Old Orchard Beach, Maine. When the hotel had been closed for the winter, it was left without automatic fire protection or watchman service. The suspicious fire was beyond control when discovered by a policeman at 3:50 A.M., Nov. 20.

Glen Perrins

As illustrated by this $623,500 department store fire at Boise, Idaho, watchmen with janitorial duties cannot be relied upon to discover fires promptly. Originating in the basement, the fire burned at least 15 minutes before discovery by the watchman. Telephone wire by then had been damaged by the fire, delaying fire department notification.

Jack Fowler

Two guests were killed and four were injured in fire that destroyed the Hotel Morton at Berwick, Pa. The fire originated in the basement of the unprotected building and spread up an open stairway. A garbage man discovered the fire and pulled a street fire alarm box at 2:44 A.M. on January 4.

1958 Large Loss Building Fires —

Alarm of Fire

The alarm of fire is the second step in fire control operations. Just as detection should immediately follow ignition, so should the alarm instantly follow detection.

Of the 286 large loss building fires an immediate alarm was given for 222. There was no alarm in 4 cases. The alarm was delayed in the remaining 60 cases (21 percent).

Alarm vs. Detection

There is often some confusion between "delayed detection" and "delayed alarm." Early detection of a fire does not necessarily mean that the alarm will be sent with little or no delay as shown by the following case history of one of the 1958 large loss fires.

March 27, Tacoma, Wash., Tacoma Laundry $399,000

COMMERCIAL LAUNDRY. This 19,750 sq. ft. 1- and 2-story wooden laundry building was fully protected by a central-station-supervised automatic fire detection system. The building was also fully occupied by a working shift of 63 employees when this fire started. In spite of these conditions the fact that the building was fully occupied, and equipped with an automatic detection system, the fire burned for at least an hour and 20 minutes before the alarm was finally transmitted simultaneously to the central station by the alarm system and to the fire department by telephone from persons in the plant.

It all happened this way. The laundry formerly burned sawdust as fuel. This smoky fuel caused some complaints in the neighborhood, and the laundry had recently switched to a cleaner-burning gas fuel.

A woman living in a nearby dwelling hung out her laundry about 9:30 A.M. on this clear, breezy March morning. She then sat down at the kitchen table about 9:50 A.M. to "do" her nails and later recalled noticing black smoke coming from the roof of the laundry near the base of the chimney. She was accustomed to seeing smoke coming from the laundry, however, so didn't think of fire, although she did worry about her own laundry being soiled by the smoke.

About 10:30 A.M. the proprietor of a gasoline station down the street smelled tar smoke. He discussed it with his wife and a customer but did not consider that anything serious was occurring. At 11 A.M. a nearby used car dealer ran into the service station yelling "laundry's on fire." They stood outside watching the progress of the fire and waiting for the fire engines to arrive. No one was leaving the building.

Also at 11 A.M. the woman at her kitchen table saw people looking at the laundry roof. She went outside and saw flames amid the smoke. She returned to the house as she was expecting an 11 A.M. phone call. It came and then she attempted to call her husband to tell him of the fire, but found the phone dead.

Tacoma Fire Department

About this time a driver of a delivery truck drove out the alley across the street to start his morning rug pickups and saw the fire. He also saw the women working in the laundry building at their machines unaware of the fire. He yelled to occupants of the rug store to give the alarm. He then ran to the laundry and called through the windows to the women at work. One woman said she "thought it was getting smoky in here." One employee pulled a manual fire alarm box connected to the building fire alarm system, while an office girl phoned in the alarm at 11:14 A.M.

When the people in the gas station realized that they had been standing for a long time and no apparatus had appeared, they picked up the phone and called the fire department but were told the alarm had just come in.

The fire was thought to have been caused by the company boiler stack or from sparks on the built-up tar paper roof. As it burned on top of the roof, it was hidden from direct view from inside the plant and the breeze blowing (20-30 mph) kept the exterior fire from operating the interior automatic alarm devices.

Alarm Response

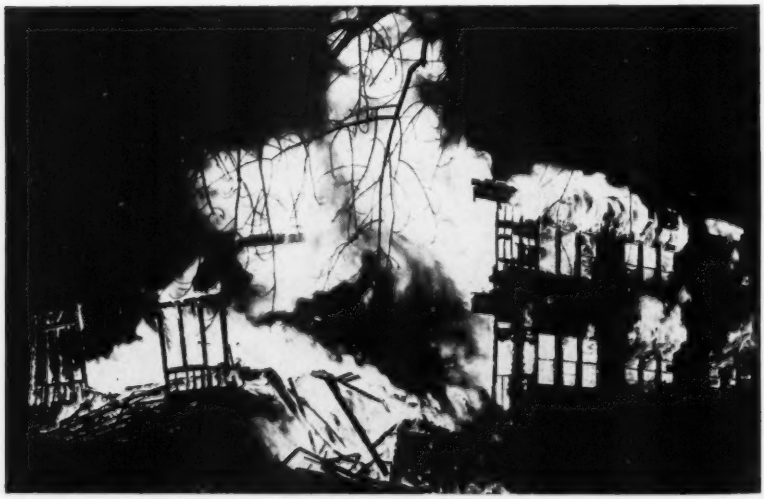
All property owners should have a vital interest in the availability and reliability of their public fire protection services unless they are completely independent by virtue of their own private protection (which is rarely the case). Response time is often critical as well as the amount of the protection immediately available including equipment and manpower, and the status of the training of the fire fighters.

The following case illustrates the need for adequate planning for response to the alarm.

Jan. 23, Loretto, Pa., St. Francis College $280,000

College Library and Laboratory. A fire, thought to have been of incendiary origin, was discovered at 5:20 A.M. by an automatic fire alarm system in this 2-story and basement, unsprinklered, wood, college laboratory-library building. The watchman had been through the building only 20 minutes before. The fire spread quickly over the wood walls and up the open stairways.

By the time the distant fire departments (6-18 miles away) arrived only the neighboring buildings could be protected. Destroyed along with a chemical lab, a biology lab and a 45,000-volume college library, were personal libraries, a master's thesis, 500 slides prepared for a doctor's thesis, and two rare books printed before 1500. The school's previous 15,000-volume library had been entirely destroyed ($250,000) in 1942, and in 1957 a $30,000 fire destroyed another building. None of these buildings had been sprinklered and none had fire-resistive containers to protect valuable records.



Mountaineer Herald

Reasonably prompt discovery of fire at this Loretto, Pa., college building was assured by regular tours of a watchman and by an automatic fire alarm system. The fire was discovered by the fire alarm system, but the advantage gained by prompt discovery was lost by the time required for fire departments to respond. See report, this page.

St. Louis Post-Dispatch

Fire was beyond control in this brick and tile plant at St. Louis, Mo., when discovered by a passing motorist at 11:51 P.M. Overlooking a fire alarm box directly across the street, he drove ½ mile to another box to give the alarm. A watchman who made rounds every three hours had last toured the building at 9 P.M. on Sept. 15.

Alarm Means

The initial alarm of fire was made by telephone in 181 cases, by street-mounted fire alarm box in 44 cases, by radio in 17 cases (police — 16, fire — 1), by private fire alarm box in 6 cases, by automatic sprinkler equipment in 4 cases and by central-station-supervised automatic fire alarm equipment in 4 cases. The remaining 16 alarms were given by miscellaneous methods.

Feb. 13, Cincinnati, Ohio, Queen City Industries $286,000†

CLEAN RAG AND SCRAP PAPER STORAGE AND PROCESSING. The first floor of this unsprinklered 87 ft. by 162 ft. 4-story fire resistive with wood roof building was reinforced concrete. Under this floor was a concealed crawl space which still had the wooden concrete forms in it. It is reported that an attempt to thaw pipes somehow ignited these wooden forms.

The concealed fire burned undetected for several hours until it reached the base of the elevator shaft. As it spread up the shaft to the roof it was seen about 10:30 P.M. by a passing motorist who pulled the nearby street fire alarm box. Blocked fire doors, large concentrations of combustible stock, and no sprinklers led to the large loss.

†Includes business interruption loss.

Feb. 18, Baltimore, Md., Sandler's, Inc. $538,000

DEPARTMENT STORE AND ATTACHED WAREHOUSE. The store officially closed at 5:30 P.M., but the owner and his son-in-law remained in the building until the central-station-supervised burglar alarm was set at 6:03 P.M. A few minutes later a passerby saw smoke in the building and mentioned it to a clerk in a drugstore across the street. The clerk notified the drugstore manager who stepped outside to verify the report. A policeman in a passing patrol car also noticed the smoke and radioed the alarm at 6:12 P.M. About the time that the drugstore manager was telephoning the alarm (6:15), the burglar alarm indicated a short circuit and the central station company dispatched a runner.

The fire spread vertically from the basement to upper stories of the 45 ft. by 65 ft. unsprinklered 4-story brick, wood-joisted warehouse. One reason for the rapid vertical spread of fire was that gaps had appeared in the matched ⅞-inch thick flooring. This flooring had been green when it was laid. The shrinkage of this lumber left ¼- to ½-inch open slots between all floor boards.

Smoke and water damage to the attached 45 ft. by 132 ft. 3-story fire-resistive with wood roof store building was extensive. The fire department was hampered by cars, abandoned during a 15-inch snowfall the day before, and by windowless walls on all sides of the warehouse above the first floor.

***Feb. 18, Logan, Ohio, Johnson Building et al. $371,000**

STORES, OFFICES, APARTMENTS. Fire of suspicious origin apparently started in a vacant apartment in a 40 ft. by 150 ft. 2-story brick, wood-joisted business-apartment building. The fire, burning undetected, spread into the undivided concealed roof space. The occupants were asleep until the sound of breaking glass awoke one of them who aroused the others in time for all to escape. One of the occupants then ran to the fire station one block from the burning building to sound the alarm.

By the time the fire department was on the scene and mutual aid companies called, the fire had warped several of the unprotected I-beams supporting the roof. These twisting beams opened holes in one of the party walls, allowing fire to spread into a similarly constructed adjoining building. Both buildings were destroyed.

March 13, Norwalk, Conn., The S & Y Building Corp. $335,000†

FERTILIZER, HORTICULTURAL PRODUCTS, KNITTED GOODS, ETC. (TENANT MANUFACTURING). A fire of undetermined origin was first discovered about 3:15 A.M. when a night boiler operator working in a basement pump room smelled smoke. On investigation he found that smoke was issuing from under the fire door which led to a 1-story and basement 75 ft. x 300 ft. brick, wood-joisted section of the sprinklered building. The boiler operator notified the building superintendent who happened to live on the premises. Nine minutes later they telephoned the fire department because the smoke was getting thicker.

The fire fighting was hampered by the heavy smoke issuing from the burning horticultural products in this basement section. Even though masks were used, 18 fire fighters required hospital treatment. Seven hours were required for extinguishment although the building damage was confined to the basement of the section involved, except for partial collapse of the first floor.

This fire would not have approached large loss size had it not been for the tremendous amount of smoke damage to the remainder of the property, especially to the knitted goods.

Investigation after the fire disclosed that the sprinkler control valve for the section involved had been closed. An extensive investigation was carried out, but no reason for this closure was found.

*Fire spread to other buildings.

†Includes business interruption loss.

Peterborough Fire Department

Fire that destroyed the Empress Hotel at Peterborough, Ont., originated on a steak grill in the Coffee Shop. Occupants thought they had extinguished the fire, and the fire department was not called until an outsider saw fire coming from the roof vent. **See report, page 277.**

Worwick's Studios

Occupants fought the fire, delaying fire department notification at this McHenry, Ill., boat sale and storage building. See report on this page.

Occupants Fighting Fires

The most frequent reason for the 60 delayed alarms was the occupant who chose to fight the fire rather than give the alarm, thereby delaying the arrival of fire fighters. There were 25 such cases among the 1958 large building fires. One occupant was a watchman.

Jan. 14, McHenry, Ill., North Bridge Marine Service Co. $576,500†

BOAT SALES WITH STORAGE AND SERVICE. There was a 10 to 12 minute delay in reporting this early morning fire. Part of the delay was due to occupants fighting the fire and part was due to difficulty with the telephone.

A showroom was being remodeled in this 75 ft. by 200 ft. 1-story concrete block, steel frame building. The suspended ceiling of the showroom was insulated with combustible materials. During the early morning welders had been working in the area on a new hot water heating system. Sometime after they had finished, the manager saw smoke coming from the area (about 9:35 A.M.) and climbed a ladder to find a fire burning in the insulation. He attempted to extinguish it by using two 5-gallon foam extinguishers and one 1-quart carbon tetrachloride extinguisher. As the extinguishers reportedly caused no noticeable effect on the flames, an employee was urged to call the fire department but was unable to make contact with the operator from either phone in the building. Another employee ran across the street to a bowling alley. Finding it locked, he broke in. While doing so, he was asked by a neighbor what was going on. After receiving an explanation, the neighbor phoned the fire department (9:47 A.M.) while the employee collected an extinguisher from the bowling alley, and returned to find the fire through the roof.

A concrete block wall with double fire doors kept the fire from entering one adjoining 40 ft. by 225 ft. all-metal wing, while good fire fighting operations kept the fire from a similar communicating wing on the other end of the building.

†Includes business interruption loss.

Delayed Telephone Alarms

Of the 60 delayed alarms 20 were due to difficulty with telephoning. In 8 of these fires the alarm was delayed due to burned telephone wires, in 6 cases the discoverers called the wrong party, in 4 the telephone was inaccessible, and in 2 the telephones were in use.

Jan. 27, Walworth, Wisc., Perfect Seal Manufacturing Co. $387,500†

Leonard Church, Jr.

ROCK WOOL MANUFACTURE. A short circuit of old electrical wiring was thought to have caused this fire. The sparks ignited paper bags and cardboard cartons stored nearby.

The night boiler operator smelled smoke and upon investigation found its source to be a second floor fire in this unsprinklered 11,600 sq. ft. 1- and 2-story concrete block, wood-joisted building. An attempt by the boiler operator to reach a phone in the office was thwarted by the dense smoke. Leaving the plant, the man ran 200 feet to the plant owner's home; and after he had awakened him and explained the situation the alarm was phoned in at 4:45 A.M.

The fire, fed by the combustibles already mentioned and the wooden partitions, floors and ceilings, destroyed the office and factory areas.

March 15, Genoa, Ill., Falls Products, Inc. $400,000

POWER LAWN MOWER MANUFACTURER. A motorist passing through town spotted a fire about 4:20 A.M. burning in this 24,000 sq. ft. 1- and 2-story cement block, wood-joisted factory. He reported the fire to a local milkman who was working nearby. The milkman went to a public telephone and dialed "O". He was connected to an operator in the De Kalb, Ill., telephone exchange. This operator assumed that the call was a request from the fire department for mutual aid, so she called the Sycamore, Ill., fire department, which had been assigned first outside response.

Meanwhile, the milkman proceeded to the fire and stood for seven minutes awaiting the siren and fire forces. Hearing no activity, he returned to the telephone booth and dialed the fire department number. This call was received at 4:30 A.M. By the time the fire department arrived the fire was through the roof of the factory section and had spread into the rest of the building. Cause of the fire was attributed to a gas-fired degreaser which had not been shut off at the end of the working shift and therefore overheated. The building was a total loss.

Dec. 11, Eugene, Ore., Elks Club $475,000

CITY CLUB. Just after 2 A.M. a customer, leaving a cafe two doors down the street from this 80 ft. by 116 ft. 2-story brick, wood-joisted lodge, saw smoke coming from the building. Returning to the café, he reported this fact to the manager and they tried to call the fire department, but the telephone was dead. Subsequent investigation showed that the phones on this section of the block were served by a cable and terminal block in the basement of the Elks building. Being unable to call in the alarm, the men ran to the street where they hailed a passing police cruiser. The patrolman was able to radio the alarm. There is no explanation why those who discovered the fire did not use a fire alarm box located across the street.

Difficulty was encountered in entering the building and the heavy smoke hampered vision. One hour and three alarms later the fire, that had started near a refrigerator motor in the basement, had spread up open elevator shafts and stairways to the upper floors where it fed on combustible interior finish and draperies.

Other Delayed Alarms

Of the remaining 15 cases of delayed alarms occupants who investigated first (4), and lack of a fire alarm box (2), were the principal reasons.

†Includes business interruption loss.

1958 Large Loss Building Fires —

Spread of Fire

The 1958 large loss analysis proves again what has already been shown in previous large loss studies, that large loss fires usually occur when fires spread over large areas. The principal means, therefore, for preventing large loss fires is the limitation of fire spread by the provision of fire walls and other structural features, and by the provision of automatic fire extinguishing equipment (See Private Fire Protection.) It is true, of course, that a few fires each year cause a large loss without leaving the room or area of origin. These fires, however, are the exception as shown by the fact that construction weaknesses were a factor in 246 (86 per cent) of the 286 fires.

The following material is divided into subsections that cover the extent of fire spread and construction features which influenced their spread.

Extent of Fire Spread

Confined to Room of Origin

In 8 cases (2.8 per cent) the fire did not spread beyond the room or area of origin.

Feb. 17, Santa Monica, Calif., Douglas Aircraft Co., Inc. $560,000

AIRCRAFT MANUFACTURE. The appointments in a DC-7 fuselage were being completed. The finished upholstery was protected from construction damage by flameproofed canvas covers. Varnish impregnated honeycomb paper core and plastic surfaced partitions were in place. These partitions were protected from construction damage by corrugated cardboard taped in place. Parts cartons, paper wrappings, rubber mats and wiring were also in the cabin area. The cabin ceiling was insulated with a fiber glass insulation on a flameproof canvas backing. The binder for this glass wool was a resinous plastic that gave off flammable vapors at a relatively low temperature. Thus, while the glass and the canvas would not support combustion, the binder would.

An employee used some toluene from a one-pint plastic squeeze-type bottle to clean smudges off the wall of a small toilet compartment. Following the cleaning, an electric drill was used in this compartment. The toluene vapors ignited, probably from the sparking of the electric motor, and set fire to the cardboard partition coverings which ignited the plastic partitions themselves. The partitions ignited the fiber glass insulation binder and flames spread on this binder the length of the fuselage.

The fire was confined to the fuselage by building sprinklers, by removing other nearby fuselages and by plant fire brigade hose streams. Extinguishment inside the fuselage was principally accomplished by use of fog hose lines. A special metal-fire extinguishing powder was used on the fire in a magnesium beam.

July 24, Houston, Texas, Gulfgate Shopping City $852,000†

SHOPPING CENTER. This fire was confined to a small 15 ft. by 37 ft. first floor shoe stock room. An hour after this multi-building shopping center had closed for the night a private patrolman traced smoke to a small shoe stock room in the first story of a 46,000 sq. ft. 1- and 2-story masonry, steel-framed building and immediately telephoned the fire department. Since there was no sprinkler protection, the fire department used three 2½-inch and two 1½-inch hoses to hold the fire to the stock room. They had it out in half an hour but during this time dense, black smoke from the burning shoes filled the first story and went through an escalator opening to the second story, causing extensive smoke damage throughout.

The various buildings of the center had 4-ft.-deep concealed spaces over their first floor ceilings and were connected by walkway canopies that had similar concealed spaces. All concealed spaces were interconnected. Entering the concealed space of the building where the fire occurred, smoke spread via connecting concealed spaces to a second building where smoke damage resulted.

†Includes business interruption loss.

Confined to Floor of Origin

In 10 cases (3.5 per cent) the fire spread beyond the room of origin but was confined to the floor of origin.

Aug. 14, Asheboro, N. C., Hudson Belk Co. $263,000

DEPARTMENT STORE. Fire was limited to the second floor of this 75 ft. by 160 ft. 2-story brick, wood-joisted store by good fire fighting. The fire, believed to have been caused by lightning, was discovered when police in a cruiser saw smoke coming from the second story of the occupied building about 2:25 P.M. The fire was held to the second floor of the building, where it caused complete destruction of everything but the brick walls and steel columns.

Salvage covers were used on the first floor but did not prevent heavy stock losses to the merchandise due to smoke and to large amounts of water from hose streams that penetrated to the first story before the covers were spread.

Confined to Building of Origin

In 188 cases (65.9 per cent) the fire spread beyond the room of origin and beyond the floor of origin to destroy the entire building.

Feb. 13, Erie, Pa., M. V. Irwin Co. $2,180,000

MISCELLANEOUS STORAGE. The largest of six fires that broke out in as many weeks in this Pennsylvania city spread throughout this all metal warehouse causing a total loss. Each one of these fires was well advanced on discovery and occurred around 5 A.M. or around 5 P.M. in a storage building. The suspicious fires stopped after the prime suspect had been given an unsuccessful lie detector test.

An occupant discovered this fire about 5:45 P.M. burning in a pile of paper bags filled with polystyrene plastic stored in the center of this heavily loaded 110 ft. by 400 ft. 1-story all metal building. The spread of fire was so rapid that extinguishers were useless.

Charles McCormish

Lack of sprinkler protection and division walls permitted fire to spread throughout this heavily loaded 44,000 sq. ft. noncombustible "miscellaneous storage" warehouse at Erie, Pa. This fire was one of six of suspicious origin that occurred in Erie during the early part of 1958. See detailed report on this page.

About this time outsiders saw the smoke and pulled a street fire alarm box.

With no sprinklers or building divisions the fire had little to stop its spread. The furniture, plastics, chemicals, appliances, gas ranges, refrigerators and T.V. sets all added fuel to the fire.

Spread Beyond Building of Origin

In 74 cases (25.9 per cent) the fire was able to spread beyond the building of origin and into other buildings.

***Feb. 24, Vergennes, Vt., Adams Hardware Store, et al. $500,000**

12 Apartments, 9 Stores, 3 Offices, 2 Restaurants, 1 Inn, 1 Dwelling and 1 Garage. This fire destroyed two buildings and damaged two others, involving over half of the buildings in this 200 ft. by 225 ft. block. It started from the ignition of unidentified vapors by the flame of an oil burner in the hardware store basement of a 3-story wooden building. An explosion just after 1 P.M. alerted occupants. Spreading throughout the basement, the fire was able to go up open stairways to all floors.

The fire leaped a 12-foot alley and entered, through plain glass windows, the first floor of a 60 ft. by 70 ft. 2-story and attic brick, wood-joisted building. A 3-story and attic, brick, wood-joisted building adjacent to one side of the 2-story building was involved when fire ignited the overhanging roof. On the other side of the 2-story brick structure, there was a 2-story stone building with metal roof. The exposed walls of the practically adjoining buildings were blank except for a window in the attic of the brick building which exposed the metal roof of the stone building. The exposing fire from the window heated the metal roof until an explosion occurred in the 2-ft.-high concealed space beneath the roof. The roof was blown open, the second story ceiling was blown down, the partitions were moved and the windows blown out. No fire ensued.

Heat from the fire caused additional damage to other buildings, such as paint blistering and window breakage up to 90 feet across the streets. None of the buildings had interior or exterior sprinklers.

Outside Fire-Spread into Building

And finally in 5 cases (1.9 per cent) a fire that started outside of the building was able to spread into it.

Nov. 11, Evansville, Ind., Penny Can Market, Inc., et al. $375,000†

Market, Tavern, Apartments. Fires sometimes spread into buildings from the

*Fire spread to other buildings.

†Includes business interruption loss.

Charles F. Martin

This grocery store fire at Evansville, Ind., originated in trash that had been left outside the rear of the building. See detailed report on this page.

outside. The tavern owner leaving about 12:20 A.M. tossed some trash into the trash truck parked behind this 75 ft. by 150 ft. 1- and 2-story mostly wooden building. A motorist who first noticed the fire said the truck body was red hot and that he immediately (12:42 A.M.) telephoned the fire department from the street booth in front of the store.

The overheated truck ignited a closed overhead door in the rear of the building. Spreading up the door, the fire entered the building through a crack between the top of the door and the top door frame. It then ignited stock piled against the door in the rear service area of the market. From the service area it entered the concealed space above the sales area. Firemen fought the fire in the service area, unaware that above them the fire was racing along in the unsprinklered concealed ceiling space. A good portion of the unsprinklered building was destroyed.

Building Construction

All types of buildings were involved in the large losses of 1958. Ten fires (3.6 per cent) occurred in buildings of fire-resistive construction; 31 fires (10.8 per cent) occurred in noncombustible buildings; 3 fires (1.0 per cent) in noncombustible buildings that had combustible roofs and 132 fires (46.2 per cent) burned in buildings of masonry, wood-joist construction. All-wooden buildings experienced 49 fires (17.1 per cent); wood-framed, metalclad, 15 fires (5.2 per cent); mixed construction, 29 fires (10.1 per cent); buildings of miscellaneous other construction and those for which construction details are not available accounted for the remainder.

Joseph's Photos

This Jan. 4 $260,500 fire in Brooklyn, N. Y. was one of the 132 large loss fires involving brick, wood-joisted buildings. It originated in the basement of the 4-story multiple occupancy manufacturing building and spread via pipe openings to upper stories.

Oregon State Fire Marshal

One of the 49 large loss fires in all-wooden buildings occurred in a sawmill near Klamath Falls, Ore. The two buildings destroyed in this Feb. 20 fire were the only major structures at the plant that were not sprinklered. See detailed report on page 296.

United Press

The $700,000 fire in the Museum of Modern Art in New York City on April 15 was one of ten large losses in 1958 to occur in a fire-resistive building. See page 276 and July 1958 NFPA Quarterly.

Inadequate Fire Divisions

The principal structural factor in the *horizontal spread* of fire is the failure to provide adequate division walls. Absence of such a division wall (instances where good judgment would have recommended subdivision) was noted in 75 per cent (214) of the fires. Substandard construction of the wall itself was a factor in 9 cases (3.1 per cent).

Feb. 25, near Clarksburg, W. Va., Thorofare Food Market et al. $300,000

SUPERMARKET, STAMP REDEMPTION CENTER. Shortly after midnight a fire broke out in the sales area of this 17,000 sq. ft. 1-story masonry, wood-and-steel-framed supermarket. With no automatic fire detection or watchman service to discover the fire and no automatic sprinklers to discover and extinguish it, the fire burned until seen by a taxicab driver about 1:25 A.M.

Breaking through the wood roof of the store, the fire spread over the top of an unparapeted division wall and burned down through the roof of an adjoining stamp redemption store in the building.

Fire Wall Openings Not Protected

In 29 cases (10.1 per cent) openings in the division wall were a factor in the *horizontal spread* of fire. In 14 cases window or door openings were unprotected while in 4 instances unprotected conveyor or belt openings allowed fire to spread through the barriers. Six division walls were protected in a substandard manner, 4 with ordinary glass windows, and 2 with substandard fire doors. Five fire doors were blocked open or otherwise inoperative thereby permitting fire to spread beyond the division walls in which they were installed.

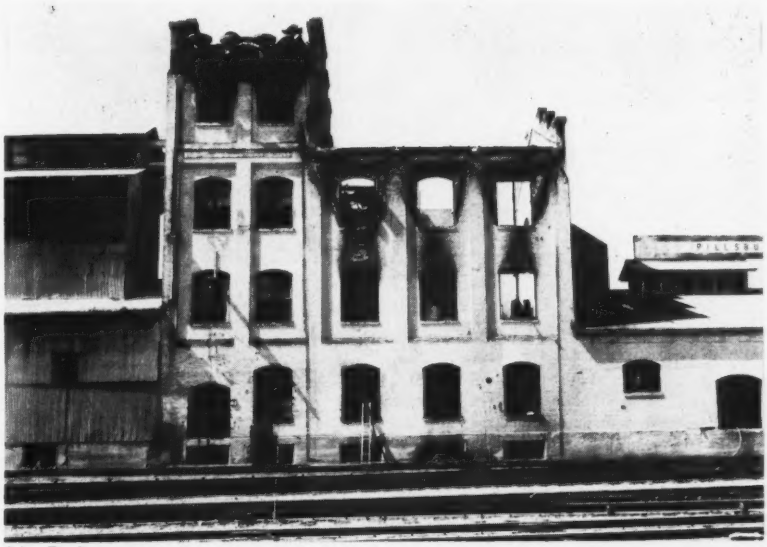
Feb. 3, Louisville, Ky., R. C. Tway Co., Inc., et al. $804,000†

STORAGE OF BUILDERS' SUPPLIES, AIR FILTER MANUFACTURING. A sprinklered 35,000 sq. ft. 2-story brick, wood-joisted building used for the manufacture of air filters was adjoined by an unsprinklered 35,000 sq. ft. 1-story wooden building used partly for air filter manufacture and partly for storage of builders' supplies. The division wall between the

†Includes business interruption loss.

Charlotte Observer

The Oakhurst Elementary School at Charlotte, N. C., was destroyed by fire on Oct. 31. Originating in the main section that connected two wings, the fire spread to the wings (left and right of photo) because doors in division walls had been propped open.



Colton Fire Department

Fire at the flour mill at Colton, Calif. on Oct. 2, spread through open stairways in the 3-story section at right of photo and into the 4-story section at left by means of a 2-ft. by 3-ft. conveyor opening at the third story level in the party wall between the two sections.

Louisville Courier-Journal

The sprinklered building in the rear of the photo was destroyed when fire that originated in the unsprinklered building in the foreground spread through plain glass windows and a conveyor opening in the party wall. See report of fire at Louisville, Ky., previous page.

two buildings had plain glass windows at the second story level and was pierced by an unprotected conveyor opening and by several door openings protected by poorly maintained unapproved fire doors.

The fire was discovered simultaneously by the plant watchman who patrolled the 32-acre installation and by policemen outside the plant who used their cruiser radio to transmit the alarm. The plant watchman had passed this building in his car less than ten minutes before and had seen nothing unusual — now he found flames involving the outside wall of the wooden section and heard the outside electric sprinkler alarm ringing.

Spreading through the openings in the division wall, fire opened most of the 433 sprinklers in the sprinklered section thereby overpowering the water supply. Both buildings were heavily involved upon arrival of the fire department, which then concentrated on protecting the exposures.

***Dec. 11, Gloucester, Mass., The Oceanside Hotel, Inc. $750,000**

Charles A. Lowe

SUMMER HOTEL. This 49,000 sq. ft., 6-story, 400-room, irregularly shaped, wooden summer hotel built in 1880 was completely destroyed by a fire of suspicious origin. The fire was giving off flaming brands when discovered at 2:35 A.M., even though no sign of fire had been noticed by passing police or neighbors around 2 A.M.

The hotel and six attached stores were unoccupied for the winter season. Because of open stairways and elevator shafts, long unbroken corridors, lack of firestops and fire walls throughout, and the lack of either automatic sprinklers or alarm systems, the fire remained beyond control of the fire fighters.

The hotel was separated from six 1-story stores by a parapeted brick fire wall with the communicating opening protected by a fire door. However, this protection was invalidated as the fire door had been blocked open.

In addition to the destruction of the hotel and six stores, two nearby cottages were destroyed and six surrounding buildings damaged.

*Fire spread to other buildings.

Horizontal Spaces Not Firestopped

The second major structural weakness affecting *horizontal fire spread* is nonfirestopped concealed spaces. Of the 50 fires (17.5 per cent) in which this construction weakness showed up, 43 (15 per cent) involved nonfirestopped ceilings where good judgment would have suggested safeguarding the open areas. The remaining 7 fires were in other nonfirestopped concealed spaces.

Jan. 18, East Chicago, Ind., St. Stanislaus School, et al. $500,000

PAROCHIAL SCHOOL AND COMMUNITY HALL. A passerby saw smoke coming from the second floor of this 120 ft. by 133 ft. brick, steel-framed school. He pulled a nearby street fire alarm box which brought the fire department.

Using the school standpipe hose system, the fire fighters attempted to locate the seat of the fire. Flames had spread above a basement banquet hall in the concealed space under the sloping auditorium floor. From there, fire spread through nonfirestopped walls to the roof and, after breaking into the auditorium, spread up open stairways.

The building was completely destroyed.

Washington Post

This multiple occupancy store fire at Washington, D. C., Feb. 19, illustrates the difficulty of fighting fires in concealed spaces. The fire originated in the basement of the unsprinklered building and spread up an open rear stairway to an inaccessible attic where it mushroomed.

Vertical Openings Not Enclosed

The principal factor in the *vertical spread* of fire is the failure to enclose vertical openings or the failure to provide standard enclosures for these openings. In 162 cases (56.6 per cent) this was the reason for extended vertical spread of fire. Open stairways accounted for 89 of these 162 cases.

Dec. 24, Mount Joy, Pa., Lancaster Leaf Tobacco, Inc. $600,000

Tobacco Storage. Fire, originating in the basement of this unsprinklered 60 ft. by 225 ft. brick, wood-joisted tobacco storage building, burned up open stairways to the first floor before it was stopped by firemen from eleven surrounding communities.

Starting from a short circuit in a light socket, this Christmas Eve fire created enough smoke to hamper seriously the fire fighting efforts. The dense tobacco smoke also served as an alarm of fire as it was strong enough to attract the attention of the fire chief who was in a nearby fire station.

Open elevator shafts were a factor in 27 fires (9.4 per cent).

April 20, Greenville, S. C., Emaxcee Building, et al $561,500

Offices and Furniture Storage. A Sunday morning fire destroyed this partially sprinklered 9,000 sq. ft. 3-story and basement brick, wood-joisted building. The fire, originating in a janitor's closet on the second floor from defective wiring, burned a small hole in the ceiling and entered the third floor (furniture storage). Here the fire gained considerable headway by feeding on the combustible packing material for the furniture. The floor was well loaded for a forthcoming sale.

The building was "U" shaped and the wings were connected by a metal-covered passageway at third floor level. The fire spread from the wing of origin through this passageway to the other wing and soon totally involved the structure.

The partial sprinkler system in the basement was called upon only when burning

material dropped down the elevator shaft. One sprinkler held the fire until hose streams could complete the extinguishment.

Fire damage was held to the third floor and the roof, but water damage was so heavy to lower floors that the building can be considered a total loss.

Other unprotected openings affecting vertical fire spread were 7 conveyor openings, 6 pipe openings and 11 other openings.

Substandard enclosure of stairways, elevators and other vertical openings accounted for 22 cases of fire spread (7.7 percent of building fires).

***Feb. 11, Rochester, N. Y., Nerfain, Inc., et al- $465,000†**

PLASTICS FABRICATING, AND STORAGE OF WOOD PATTERNS. Fire of undetermined cause broke out on the vacant first floor of this 48 ft. by 93 ft. 5-story brick, wood-joisted, building. As the building's sprinkler system was shut off the fire spread up through an elevator shaft.

The elevator enclosure was a light wooden board covering on wood studding. The fire burned through the sheathing and flames spread through the top (fifth) floor and then jumped a low parapet and burned the roof off a similar adjoining 48 ft. by 150 ft. building.

The nearly vacant building of origin was in the hands of an untrained superintendent who evidently did not understand how to heat or protect the building. The heat was turned on only during the days when the temperature dropped below 15°F. and not at all on week ends. The sprinkler system had already frozen once a few weeks before the fire but it was supposedly repaired. The three days (Saturday, Sunday and Monday) previous to the fire had been 11°F. and below, with Tuesday's temperature about 7°F. The fire occurred Tuesday night. No sprinkler operation was noticed during the fire. An after-the-fire investigation showed that the three post indicator sprinkler valves controlling water supplies were closed.

*Fire spread to other buildings.
†Includes business interruption loss.

Pekin Daily Times

An open stairway was the means by which fire spread from the basement to the top of this unsprinklered furniture store building at Pekin, Ill., on Sept. 15. The fire was out of control when discovered by an outsider at 1:15 A.M.

Vertical Spaces Not Firestopped

The second largest factor in the *vertical spread* of fire is the nonfirestopped concealed spaces in walls or partitions. Of the 43 such cases, 42 were due to nonfirestopped walls.

Feb. 6, Clinton, Mass., Clinton High School $352,500

PUBLIC SCHOOL. This 80 ft. by 85 ft. 3-story and attic brick, wood-joisted high school was originally built in 1885. In 1935 it was heavily damaged by a $100,000 fire, after which it was rebuilt with WPA labor. No sprinkler system was installed at the time of the rebuilding.

This present-day fire started in a basement storeroom from overfused obsolete wiring that overheated. The fire burned undiscovered until around 4 A.M., when a passer-by saw it from outside the building and notified the police department who called the fire department. This delay in alarm had little effect on the outcome as the fire had already entered the nonfirestopped walls and was spreading up through the building.

The fire fighters were unable to halt the blaze and at 6:45 A.M. the fire finally broke through the roof.

An after-the-fire investigation found an electric wall clock that had stopped at 3:37 A.M., 23 minutes before discovery.

Combination of Deficiencies

The action of a typical fire, spreading both horizontally and vertically, is well illustrated in the following case.

***Dec. 2, Baker, Ore., Levinger's Rexall Store, et al. $475,000**

MERCANTILES, CITY CLUB. A drugstore basement incinerator was overworked all day burning wrappings from Christmas stock. The incinerator door was not closed properly in the employees' rush to leave at 6:30 P.M. Burning ashes subsequently dropped onto rubbish left on the floor in-

*Fire spread to other buildings.

Baker Fire Department

On Dec. 2 at Baker, Ore., fire destroyed a multiple occupancy store building and extensively damaged an adjoining bank. The fire illustrated how fire can spread through vertical openings, concealed ceiling spaces and through joist sockets in party walls. See report on this page and photo of new remodeled building on page 335.

tended for later incineration. When building occupants discovered the fire, they tried to fight it for about 12 minutes before calling the fire department.

The smoky basement fire in the unsprinklered building hampered firemen responding to the delayed alarm. The fire spread up to the first floor through a dumb-waiter shaft behind the prescription counter and ignited the combustible fiberboard ceiling of the drugstore. Entering then the concealed space over the ceiling, flames penetrated into the second story, possibly through pipe openings. The open second story extended over the drugstore and an adjoining motor club. Thus fire involved the entire top floor.

Apparently the flames then spread down an abandoned elevator shaft to the basement of the motor club. From the second story fire spread through continuous joist sockets in a fire wall between the motor club and a bank, destroying the second floor of the bank. Another fire wall between the drugstore and a furniture store held during the fire, but collapsed into the drugstore about a week later, minutes before a clean-up crew was to go to work.

Combustible Interior Finish

In 64 fires (22.4 per cent) the combustibility of the interior finish was a factor in the outcome. In 28 of these fires combustible fiberboard, either acoustical tile or sheets, was the interior finish influencing fire spread.

The remaining 36 interior finish fires involved other types of finish from pressed hardboard to plywood.

***June 16, Fort Wayne, Ind., General Industries, Inc. $449,000†**

PREFABRICATED HOMES. It is unfortunate indeed that the automatic sprinkler system being installed in this 1-story, ex-army theater was not completed in time to prevent this needless fire. The 150 ft. by 260 ft. wooden building was used for manufacture of prefabricated homes. On the day of the fire, workmen were attempting to remove some old steam heating pipes. It was de-

*Fire spread to other buildings.
†Includes business interruption loss.

Fort Wayne Journal-Gazette

A gas-fueled torch was used to loosen a joint in a heating pipe suspended beneath the combustible fiberboard ceiling of this woodworking plant at Fort Wayne, Ind. See report on this page.

Clinton Fire Department

Overloaded wiring ignited the combustible fiberboard suspended ceiling in the Modernistic Ballroom at Clinton, Iowa. See report on this page.

cided to use a gas-fired torch to free a tight joint near the combustible fiberboard ceiling. The torch ignited the fiberboard which spread the fire so fast that the workmen were driven from the building before they could operate the standpipe hose. In the absence of fire division walls or an extinguishing system the fire spread rapidly throughout the building.

It is interesting to note that the company used every employee the next morning to clean up, hired a circus tent as a shelter for tools and salvaged machinery, and working under the warm summer sun, produced its first post-fire prefabricated home ten days following the fire.

Oct. 11, Uranium City, Sask., Uranium City Hotel, Ltd. $250,000

HOTEL. This 7,800 sq. ft. wooden hotel was partially destroyed by a fire, thought to have been of electrical origin, which started in the kitchen of the building. An unexplained explosion blew out the kitchen windows and gave warning of the fire. The flames, now fed by the air from the windows, were able to spread rapidly over the combustible fiberboard and some wooden interior finished surfaces to destroy the east wing and main part of the building.

***Dec. 24, Clinton, Iowa, The Modernistic Ballroom, et al. $613,000**

BALLROOM, COUPON REDEMPTION, AUTO AND FURNITURE STORAGE AND MASONIC TEMPLE. The first story of an unsprinklered 90 ft. by 200 ft. 2-story building of mixed construction was used as a headquarters for a savings stamp redemption company, and for furniture and auto storage. The second floor was a ballroom which had been used for a high school Christmas dance the night before. One feature of the dance had been a floodlighted Christmas tree. The floodlights had been installed by the students.

The students laid the wire for the floodlights on the concealed surface of the suspended combustible fiberboard ceiling. The wire overheated and ignited the combustible fiberboard. Spreading rapidly over the combustible ceiling, the fire was able to involve the entire second floor before it was discovered by a neighbor about 4:15 A.M.

The fire spread to a masonic temple at the rear through unprotected ordinary glass windows. Both buildings were heavily damaged, as neither had sprinklers or proper exposure protection.

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*Fire spread to other buildings.

April 15, New York City, Museum of Modern Art, $700,000 1 killed.

United Press

MUSEUM. A second floor fire presumably started by careless smoking ignited non-flameproofed tarpaulins being used in the redecorating of this unsprinklered 87 ft. by 126 ft. 6-story fire-resistive art museum.

Feeding on paint in open cans, freshly painted surfaces, pressed hardboard panels, wood studs, wood scaffolding, and rubbish, the fire generated dense black smoke which traveled up air condition ducts, duct shafts, and stairways where doors were blocked open for the renovation. Only one person of the 500 in the building was killed, even though the stairs were quickly blocked by the smoke. Three visitors and 30 fire fighters were injured. Two paintings were destroyed and 7 were damaged. (For detailed report see the July 1958 NFPA QUARTERLY.)

***June 3, Syracuse, N. Y., Dans 482 Club, et al. $365,500**

TWO RESTAURANTS, DANCE STUDIO AND TWO STORES. These commercial properties were destroyed by a fire that also destroyed two adjoining 1- and 2-story brick, wood-joisted buildings.

The fire originated at the range at one end of the bar when spilled grease ignited. Two 5-pound carbon dioxide extinguishers were discharged, but flames spread quickly over a plywood wall covering in back of the range and were out of control in the unsprinklered building when firemen arrived.

Fire entered and spread through nonfire-stopped ceiling and wall spaces and then spread to the adjoining building due to the absence of a standard fire wall between the two structures.

*Fire spread to other buildings.

Aug. 5, San Francisco, Calif., Western Merchandise Mart, et al. $1,000,000

550 SALES DISPLAYS, OFFICES, RESTAURANT, BANK, GARAGE. Two fires within 1½ hours caused heavy damage to the center of this tremendous 78,800 sq. ft., up to 11 stories, and basement fire-resistive building.

The first fire was discovered about 9:30 P.M. by a cleaning lady who went to the lobby to notify the watchman of a fire in the quarters of a second floor rug display tenant. Both returned, and after the watchman verified the story, he called the fire department (9:46 P.M.). The fire was confined to two rugs which had been placed only 3 inches from a 150 watt spotlight. The rugs were removed and the premises left with windows and doors open to get rid of the smoke.

The second fire broke out in the same office but in a different area from the first. The origin is suspicious. The cleaning lady called in the alarm this time, but the open windows (for venting the first fire) and the fact that low wood partitions were ignited in this second fire resulted in much faster fire spread. These low wood office partitions, aside from adding fuel to the blaze, allowed the fire to spread rapidly over their tops while hampering access and hose stream coverage.

Building Equipment

Building equipment often has a great effect on the spread of fire as shown in the following illustrations.

Boiler Room not Cut Off

In 14 cases boiler rooms or other building equipment areas were not cut off from the rest of the building.

Dec. 12, Hamilton, Ohio, Hamilton Skotch Corp. $325,000

STORAGE OF METAL COOLERS. This unsprinklered 35,000 sq. ft. 1-story concrete block, wood-joisted warehouse was in full operation when a "flooded" oil burner resulted in the ignition of nearby cardboard cartons. Since this oil burner was not cut off from the rest of the building and because there was no sprinkler system, the fire spread rapidly through high-piled, closely stacked

Decatur Herald and Review

Originating at an oil-fired boiler in the basement, fire practically destroyed this hardware store at Decatur, Ill., Jan. 1. The boiler was not segregated from the rest of the building by a fire-resistive boiler room.

cartons of coolers. An additional fire safety deficiency in the building was stock-obstructed windows which handicapped fire fighting. Since the nearest hydrant was 1,300 feet away, the nearly total destruction of the building is not surprising.

Unprotected Ducts

Duct systems spread fire and smoke in seven fires.

April 26, Peterborough, Ont., Empress Hotel, et al. $450,000

HOTEL. While a supper steak was being turned on a hot griddle in the coffee shop, sparks flew up and ignited grease in the hood over the grill. The chef attacked the fire with two carbon dioxide extinguishers and thought he had put it out. He was not aware that fire was spreading within the greasy duct that went up through the old, 9,700 sq. ft. 3-story brick, wood-joisted building and terminated above the roof.

Later, when an outsider discovered the fire, the fire department was notified, but by then heat from the fire in the duct had ignited wood structural members in contact with the duct and fire was spreading within concealed spaces beneath flooring.

July 21, Battle Creek, Mich., Security National Bank, et al. $275,000

RADIO STUDIO, OFFICES, BANK, STORES. This large loss fire originated in the news room of a fourth floor radio studio in this 127 ft. by 190 ft. 20-story and basement fire-resistive building.

The alarm was delayed 28 minutes by the following series of events. A cleaning woman smelled smoke at 12:40 A.M. She reported it to the maintenance man who was on the eleventh floor. He called the building manager who told him to call the fire department. The maintenance man then took an elevator to the first floor and ran 600 feet to the fire station only to find the station door locked. Running back to the building, he finally telephoned the fire department at 1:08 A.M. and reported smoke in the building.

The actual fire (of undetermined origin) was confined to the 2,000 sq. ft. radio studio by the fire department during a five-hour battle. A large amount of combustible fiberboard acoustical tile and wood partition material made the fire stubborn and it burned with heavy smoke. The smoke traveled via two ventilation ducts to the upper stories of the building damaging all offices while water flowed down into the bank offices.

Battle Creek Inquirer and News

A July 21st fire at Battle Creek, Mich. (see report on previous page) was confined to a radio studio in the fourth story. Combustible interior finish, an accumulation of teletypewriter paper and several thousand vinyl plastic phonograph records contributed fuel for the fire. Smoke spread through ventilating shafts to all floors of this 20-story building.

Building Contents

If a building is fire resistive in construction and finished with noncombustible materials, then the only remaining fuel for fire is the contents of the structure. In 178 fires (62.3 per cent) the contents of the building were a factor in the outcome.

Improper Storage Practices

The largest contents factor was improper storage. Of the 74 cases where storage methods contributed to the extent of damage, 30 were due to poor stock subdivision, 15 to stock that was piled too high, and 7 to inadequate clearance between stock and windows or walls. Twenty-two cases involved other storage factors.

Oct. 27, Tampa, Fla., Galloway Mfg. Corp. $265,000

FURNITURE WAREHOUSE AND FACTORY. At 11:42 A.M. Monday morning a fire broke out in a 6,000 pound pile of foam rubber in cardboard cartons in an occupied 150 ft. by 162 ft. aluminum-covered, steel-framed furniture warehouse. The unsprinklered warehouse was connected across a 3-foot separation by a communicating enclosed passageway to a similarly constructed sprinklered factory. The sprinklered factory was protected from the unsprinklered warehouse by an outside eave line of automatic sprinklers.

The fire was discovered immediately by the workers in the warehouse. One grabbed a carbon dioxide extinguisher and the others a garden hose, and while the alarm was being transmitted by the office staff, they tried to extinguish the foam rubber fire.

This material, with its tenacious hot smoky burning characteristics, was little affected by these extinguishing efforts; the

Elmer Hinton

About one-third of this grocery warehouse near Nashville, Tenn., was destroyed by fire on March 21. At the time of the fire the building was being converted to a cold storage warehouse. Three carloads of polystyrene foam insulating slabs were piled practically to the ceiling and a welder was welding on a steam line at ceiling level. Fire caused by a welding spark quickly involved the pile of insulation and was not controlled by sprinklers due to obstruction to water distribution by the high-piled foam insulation.

Early fire fighting by the plant fire brigade and the private fire department consisted of discharging water that was carried to the scene on pumpers. The fire could not be controlled until it vented itself through the roof. Fire fighters, including several companies from Nashville, were then able to enter the building with hose streams.

Malcolm Gamble

Bales of paper were stored six to ten bales high in this former roundhouse at Asheville, N. C. Fire broke out in the bales during the night of July 1 from an undetermined cause and was beyond control in the unsprinklered building when discovered by the railway night watchman at 4:17 A.M.

fire burned on, even defying fire department attempts at extinguishment. The metal warehouse crumpled due to the heat, but the fire was kept from the aluminum-clad factory by the exterior sprinkler line and the talented efforts of the fire department.

The warehouse is being rebuilt. At last reports it will be the same construction, not sprinklered and still store foam rubber.

Flammable Liquids

Second on the list of complicating storage factors were the 71 flammable liquids fires. In 27 of these the liquids escaped from tanks and drums, in 11 cases the escape was from fuel tanks for vehicles and planes. In 9 cases the liquids were involved in process equipment, in 9 others a flammable liquid container exploded, and in 6 cases piping failed or ruptured. The remaining cases were the result of miscellaneous reasons.

***Nov. 30, Los Angeles County, Calif., Howard Ladder Co., et al. $460,000†**

WOOD LADDERS, IRONING BOARDS AND STEP STOOL MANUFACTURING. A passerby on seeing flames coming from this 15,500 sq. ft. 1-story corrugated iron on wood frame manufacturing building, pulled a street fire alarm box. The early morning fire, feeding on paint from a dipping operation as well as on poorly subdivided wooden stock got a firm grip on the plant and spread into the 9-foot alley between the plant and its office, before discovery. Here it exploded several drums of lacquer.

The lacquer-fed fire spread into the office building and across a 14-foot alley to the rear where it involved and heavily damaged a similarly constructed building housing a phonograph record company, oil filter sales and service company, and office equipment storage. With no fire divisions or exposure protection in the building group and no automatic protection the results are not surprising.

*Fire spread to other buildings.
†Includes business interruption loss.

Yacht Safety Bureau

Gasoline left in fuel tanks of boats while laid up for the winter was an important fire-spread factor at the Essington Yacht Yard at Essington, Pa., March 13. The $300,000 fire originated in a boat in one of the storage sheds and eventually destroyed or badly damaged 33 boats. The fire was detected by a watchman at the start of his 8:00 P.M. round and he promptly telephoned the alarm after gaining access to the locked boatyard office.

Poor Housekeeping

Third on the list of contents hazards were the 32 cases of poor housekeeping. In 13 cases the accumulation of rubbish was a factor, in 7 cases oily or greasy deposits were a problem and the remaining 12 were due to various causes.

*April 19, Birmingham, Ala., Decatur Transit Truck Lines, Inc., et al. $500,000

GARAGES, WAREHOUSES, SUPERMARKET, FOOD STORES. This fire destroyed over 84 per cent of a city block. Starting in the repair section of a trucking company warehouse, fire smoldered for some time before it broke through the roof of the 25 ft. by 290 ft. metal-covered, wood-framed building. This building had collapsed before fire fighters, called by the watchman, arrived. The watchman had fought the fire before calling the building owner and then the fire department, which caused an estimated 30 minute delay. Gasoline, diesel oil, and acetylene cylinders all added extra fuel to the fire already thriving on the rubbish and trash available from poor housekeeping practices.

The fire spread to a nearby 25 ft. by 200 ft. similarly constructed market building with an open attic. It also spread to trucks and trailers in the yard. Fifteen per cent of the block was saved by fire department efforts aided by a 12-inch brick properly parapeted fire wall and a 50-foot clear space.

*Fire spread to other buildings.

Gases

Fourth on the contents factor list were the 26 fires where gases were a factor. Ten fires involved natural or manufactured gas, 6 involved liquefied petroleum gas, 5 acetylene, and 5 involved other combustible gases.

Gas escaped from cylinders or storage containers in 10 fires, from piping in 8, and gas container explosions occurred in 4. In the remaining 4 cases gases were a factor for miscellaneous reasons.

Feb. 19, McCook, Ill., Reynolds Metals Co. $826,000†; 6 killed

ALUMINUM CASTING. Several minor explosions had occurred in this 160 ft. by 1,500 ft. 1-story brick, steel-trussed building due to snow and ice left on the aluminum being put into the furnaces for melting. The 6-acre building contained 38 coke-fired, 18 ft. by 40 ft. brick furnaces. Each furnace had two sections with gas burners in pouring sections to maintain pouring temperatures.

Chicago Tribune

As a load of aluminum was being dropped into one of the furnaces by an overhead crane a rather violent explosion occurred. Six were killed outright, and 40 injured.

A 48,000 sq. ft. section of roof was damaged, and almost all the windows in the large 35-ft.-high building were blown out or broken. One furnace was destroyed and several damaged, and a fuel gas line was broken which added to the ensuing fire.

It is theorized that water was introduced into the furnace from either the ice and snow on the scrap or a leak in a water cooled door. Because of the violence of the explosion it is thought to have involved hydrogen which was formed when the water reacted with the molten aluminum.

†Includes business interruption loss.

July 14, Streator, Ill., Williams Hardware Co. $600,000; 6 killed

Harold McDonald

RETAIL HARDWARE STORE. When this building opened for business at 9 A.M. Monday morning, the odor of gas was smelled. Nobody took it too seriously — certainly the building was not evacuated, nor the emergency services alerted. As the morning wore on the gas odor grew stronger and someone must have gotten the idea that an explosion could occur, but instead of evacuating the building they put up no smoking signs.

At 11:44 A.M. the fire-resistive building exploded from the cellar to the roof. The contents on all four floors ignited, the sidewalk in front of the building was split open, the windows shattered, cars in the street overturned and 4 people were killed out-

Seven men died in this million dollar gas explosion on Jan. 16 at the Merchants Ice and Cold Storage plant in Richmond, Va. Four were employees and three were visitors. It is thought that natural gas escaped from a break in a main, seeped 19 feet underground to the warehouse, where it exploded about 10:50 A.M.

right, 2 died later of burns and 4 others required hospitalization.

The cause of the explosion is unknown. The building's basement water drainage system emptied into an abandoned mine shaft, and a flood was in progress at the time. These facts suggest the possibility that mine gas may have entered the basement through the drainage system. The possibility that gasoline entered the basement from a leaking underground tank was also investigated.

***Nov. 29, Belleville, Ont., Wm. Deline Co. Ltd., et al. $480,000**

HOUSEHOLD APPLIANCES, BUILDERS' SUPPLIES, VEHICLE. Burglars using an acetylene torch to crack the safe in an appliance dealer's store building were thought to have been scared off in such a hurry that they left the torch going. The resultant fire in the 2-story wood frame building was not detected until a 3:15 A.M. explosion blew out the front windows of the shop and awoke neighbors.

Responding fire fighters were able to operate on only three sides of the building because the rear of the building abutted a river. Twenty-five newly delivered propane cylinders in front of the building ruptured due to heat from the fire. Fourteen separate explosions were counted. One cylinder rifled across the street and plowed into the veranda of a dwelling. The resulting fire was quickly extinguished. Another cylinder lopped a limb off a tree, and the top of another was found 2 blocks away.

Flames also involved an adjacent builders' supply store and broke windows in a nearby bottling plant. A jeep and a brand new custom-made trailer were also destroyed. The trailer was at the appliance shop for installation of a gas stove.

Another serious gas explosion is reported on page 311 of this QUARTERLY.

*Fire spread to other buildings.

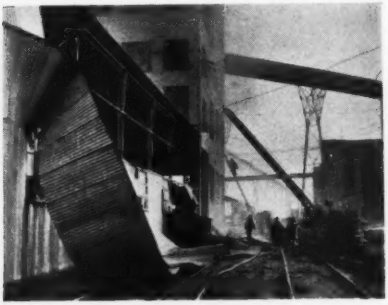
Gerry Lemay

Gas-fired salamanders ran out of oxygen, filling the airtight basement of this Sherbrooke, Que., bowling alley under construction with propane. On Dec. 15 three men entered the basement. One is thought to have struck a match. Two died in the explosion which followed.

Dust Conditions

In 25 cases dusty conditions produced by the nature of the contents seriously contributed to fire spread. In 22 of these cases dust was on structural members, and in 3 dust explosions occurred.

March 3, near Albany, N. Y., Cooperative G.L.F. Exchange, Inc. $783,000†; 2 killed



Robert E. Wilder

Feed Mill. A short series of minor dust explosions were followed by a violent explosion that injured twenty-three employees and caused extensive damage to a 9-story feed mill building. Two of the injured subsequently died.

The 100 ft. by 46 ft. building was constructed of reinforced concrete walls and floors and contained the usual equipment found in feed mills. Of special significance were twenty-nine 3-story reinforced concrete corn storage bins that extended from the third story to the sixth story where the floor formed the tops of the bins. Each bin was vented to the outside of the building, but all bins were intervented. The interventing of the bins, plus the maze of elevator legs and spouts, made it possible for an explosion originating in any one location to spread throughout the building.

The first explosion is believed to have occurred in an elevator leg that had been used

†Includes business interruption loss.

to elevate corn from an adjoining 1-story track shed up until a short time before the explosion. When the explosion occurred this elevator was running idle.

As is typical of grain dust explosions, the first or minor explosion (in this instance several minor explosions were reported) caused dust to be thrown into suspension in the grain tanks and in areas of the building where dust had accumulated on flat surfaces. When this dust cloud ignited explosively, the explosion progressed throughout much of the building because of the interventing of bins and the numerous spouts and legs.

Windows in the first through the sixth story were blown out, the sixth floor (bin tops) was blown upward and an intense fire was started in the second story where weighing, cleaning, bagging and other milling operations were in progress. Most of the twenty-three injuries occurred in the second story. Interior partitions in the second story and basement were blown down, but the reinforced concrete exterior building walls were not damaged. Damage to elevator spouts and machinery was extensive. Portions of the metalclad walls of the track shed were blown off.

Apparently, the injured had escaped under their own power or had been helped down stair towers to safety by other employees before firemen arrived. Responding to an alarm transmitted promptly by an employee, firemen connected pumpers to yard hydrants and by attacking the fire with fog-nozzle-equipped hoses taken into the building and with solid streams and water fog directed through windows, they had the fire under control in about thirty minutes.

There were 24 cases of other contents factors that were an influence on either fire spread or on fire fighting, such as the storage of explosives or ammunition.

Exposure Fires

No study of fire spread would be complete without a mention of exposure fires. In 79 fires the exposure problem was a factor in fire spread. Seventy-four fires spread from the building of origin to one or more other buildings, while 5 outside fires spread into buildings. In these fires one or more of the following items was a factor in the fire spread (listed in order of importance). Inadequate separation between buildings (32), inferior combustible construction (24), poorly constructed party walls (17), ordinary glass windows (14), explosion (12), yard storage between buildings (7), interconnecting passageway or conveyors (5), wood roof shingles (4).

H. F. Materna

A night warehouse fire on Nov. 20 at Pensacola, Fla. burned the moorings of an exposed shrimp boat. The burning boat drifted free 115 feet before the wind to ignite the upper pier (see picture). Fire fighting was confined to land for 1½ hours until a fireboat arrived.

***Feb. 22, Tampa, Fla., Crown Zellerbach Corp., et al. $460,000**

OUTDOOR ROLLED PAPER STORAGE. A five-year-old boy set fire to some grass between this rolled paper storage yard fence and the road. The fire spread to over 3,000 rolls of paper stacked on end, 15 feet high. The heat from the burning rolls radiated to and damaged an apartment house, a dwelling, a warehouse and a manufacturing building. Destroyed were a dwelling, 2 garages, 2 cars and a truck.

Fire entered the main plant building through plain glass windows and fan intake openings. Employees knocked the links out of eight sprinklers near the windows. Sixteen sprinklers operated in the exposed side of the warehouse to extinguish the paper rolls burning inside and to hold the fire.

The paper rolls had been stacked with no clearance from the fences, with only a 3-feet clearance to the warehouse, 10-feet clearance to the main plant and 10-foot aisles.

*Fire spread to other buildings.

***May 6, Pinckneyville, Ill., Superb Garment, Inc. $255,000**

DRESS MANUFACTURING. An unsprinklered 18 ft. by 60 ft. 1-story tin-clad, wood-framed loading shed was built abutting a large sprinklered 1-story brick, wood-joisted dress factory. The common wall between the shed and the factory had not been designed or altered to protect against a fire in the shed. Large ceiling-to-grade plain glass windows remained and the doorway was without protection.

A fire originating among the flat cartons stored in the shed spread through the unprotected openings to the factory. Here 18 sprinklers on the single supply sprinkler system opened to halt the fire. While the water damaged that material within reach, the smoke was able to penetrate through the entire building. It ruined thousands of finished dresses, bolts of cloth and even discolored the papers on the office desks. Less than 6 percent of the loss was to the building, the rest was mostly stock smoke damage. Had there been no sprinkler protection the loss would probably have been close to $750,000.

John P. Sparrow

Fire, starting from an oil-fired furnace backfire, ignited paints, oil and solvents stored in the furnace room of this Wildwood, N. J., Hardware Store. The April 14 fire spread to the combustible exterior and through plain glass windows to the adjacent combustible apartment house and store.

Easton Publishing Co.

Fires can spread to exposures in other ways than from the usual plain glass windows, inadequate separation, continuous joist sockets and the like. In this Pen Argyl, Pa., fire on Jan. 5 the falling wall opened up and ignited the combustible construction of the Republican Club at the right.

The club was destroyed as was a dwelling to the rear. The fire originated in and was confined to the basement of the unsprinklered multiple occupancy mercantile building at left when fire fighters arrived. Due to heavy smoke the fire fighters were unable to make an effective attack and the fire spread up open stairs and elevator shafts.

Wide World

Fire starting in a 1-story Harvey, Ill., auto sales store on Jan. 9, spread through plain glass windows to the second story of a Moose Lodge on one side and an auto wrecking company on the other. The fire station below the Moose Lodge was saved by a precast reinforced concrete second floor of the lodge.

***June 7, Perth Amboy, N. J., Ira R. Crouse Lumber Co., et al. $501,000**

LUMBERYARD AND EXPOSED PROPERTY. Fire started by a hobo or children about 8:25 P.M. this summer Saturday evening, spread throughout a large high wooden lumber storage shed before a neighbor pulled a nearby fire alarm box. The fire continued to spread before a 15 mile per hour wind to other buildings on the property and to yard-stored lumber. The fire also crossed a banked single track railroad spur to two dwellings which were destroyed, and leaped 150 feet across a six track railroad to a lumber mill. Lumber piles in the mill yard ignited, and the fire spread into a wooden storage building, a hollow tile mill work building and still another dwelling.

***Nov. 23, Festus, Mo., Waggener Store Co., et al. $383,500**

LUMBERYARD, DWELLINGS, CHURCH, MERCANTILE STORES. Two hundred fire fighters, coming from as far away as 70 miles, using 21 pumpers, battled this large blaze which threatened to become a conflagration.

*Fire spread to other buildings.

The fire, originating in piled lumber behind the storage sheds of this large area lumber yard, was spotted by neighbors and a passerby about 1:10 P.M. on this Sunday afternoon. An 8 mile per hour breeze helped the growing fire leap 25 feet to the storage sheds. The fire spread so quickly that hose laid at the side of the involved building by the first responding pumper (approx. 1:12 P.M.) was ignited before water could be put through it (1:15 P.M.).

The fire spreading through the open lumber storage also leaped to and destroyed a 45 ft. by 65 ft. woodworking and roofing material warehouse, the 95 ft. by 140 ft. lumber warehouse and office and sundry supply building, and an 80 ft. by 95 ft. business block containing four stores. Flying brands also leaped two blocks to ignite the wood shingle roof of a church.

The town's strong water supply, the separation between buildings and the rapid response of the distant mutual aid companies did much to prevent a more serious extension of this fire. None of the buildings involved was equipped with an automatic sprinkler system.

1958 Large Loss Building Fires —

Private Fire Protection

Most large loss fires become large because of the *absence* of private fire protection in high valued property; a few, because of the misuse, poor design, improper installation or inadequate maintenance of one or more of the various types of private fire protection. Typical examples of these latter cases from the 1958 large loss fire experience will be cited in this article.

Automatic Sprinklers

Any review of unsatisfactory sprinkler performance should mention the 1955 study of 58,971 sprinklered fires* which indicates that sprinklers perform satisfactorily 96.2 per cent of the time. The review here of sprinkler performance in the 1958 large loss fires will show graphically what happens when a sprinkler system is not designed for the hazard protected, is not backed up by a strong water supply or is not maintained in operating condition.

In 11 of the large loss fires (10 explosions and one severe exposure fire) where there were no sprinklers, the lack of sprinklers could not be considered a factor in the resultant losses. In 239 of the 1958 large loss building fires, lack of automatic sprinkler protection was a definite factor in the outcome.

Typical Fire in Unsprinklered Building

July 22, Stockton, Calif., Smith & Long, Inc. $2,804,000†

Department Store. A carelessly discarded cigarette was the probable cause of the basement fire which destroyed this unsprinklered 100 ft. by 150 ft. brick, wood-joisted department store building. A basement fire door between the store and an addition under renovation was locked at the time of the fire. This door kept the fire from spreading into the basement of the addition.

A maintenance man checked the entire store after it closed at 5:30 P.M., set the burglar alarm at 5:52 P.M. and left immediately. At 5:57 P.M. smoke was seen coming from the building by a passerby who pulled a street fire alarm box. By the time the engines pulled into the street from the main fire station two blocks away, the smoke was so heavy that a third alarm was called by radio.

Stockton Fire Department

The basement was heavily involved on the arrival of firemen. The fire was held in the basement for a long time, but ventilation of the area was practically impossible. Cellar pipes were ineffective due to the compartmentation of the basement. Firemen had to be withdrawn as the first floor got weaker. After this the fire was able to burn through the first floor proper, spread up the open stairs to the second floor and into the non-firestopped attic. Most of the suspended ceiling finish was combustible fiberboard.

This is a typical illustration of what can happen in a multi-story unsprinklered building.

As in 1957, 36 sprinklered buildings were involved in the large loss building fires of the year. Twenty-two had complete systems while 14 had partial systems.

*NFPA Quarterly Reprint Q48-12 (25 cents).
†Includes business interruption loss.

Warren C. Zapp

A completely sprinklered paper box factory was destroyed by fire at Bayonne, N. J. The fire originated at a paper scrap collector when paper dust was ignited. An employee who was trapped in the baling pit was rescued by other employees under the protection of sprinkler water. Sprinklers may have been holding the fire in check until a pumper connected to a yard hydrant. The fire then spread out of control. A fire department connection to the sprinkler system was not used. See report on page 309.

Completely Sprinklered Buildings

Of the 22 large loss fires in buildings equipped with complete sprinkler systems, 2 systems were not a factor in the outcome (loss was due to explosion and no fire followed) and in 6 cases the systems performed satisfactorily.*

In 14 cases complete sprinkler systems did not operate satisfactorily. Closed valves were responsible for the unsatisfactory performances in 6 cases†: in two of the destroyed properties, the sprinkler valves were closed prematurely (before the fire was extinguished), one valve had been closed for repair and not reopened, another valve was closed to prevent freezing, one was closed for building renovation and one was closed for an undetermined reason.

Three of the 14 unsatisfactory performances of sprinkler systems were because the systems were not designed for the hazards being protected.‡ In 2 of these cases explosions damaged the systems and in one the occupancy hazards were too severe.

*Five of these fires are summarized in this issue of the QUARTERLY: Santa Monica, Calif., page 263; Tampa, Fla., and Pickneyville, Ill., page 286; Gulfport, Miss., page 299; Kalamazoo, Mich., page 306.

†All of these fires are summarized In this issue of the QUARTERLY: Oshkosh, Wisc., page 243; Cicero, Ill., page 251; Norwalk, Conn., page 260; Rochester, N. Y., page 272; Corbin, Ky., page 291; Seattle, Wash., page 315.

‡Two of these three fires are summarized in this issue of the QUARTERLY: Geismar, La., page 296; Coeur D'Alene, Ida., page 297.

The remaining 5 failures were each due to separate causes.** In one case there was insufficient water for hose streams and sprinklers, in another the fire burned in concealed wall and ceiling spaces out of range of the sprinklers, in another the stock was piled too high and this piling obstructed the sprinkler distribution; an exposure fire overpowered another system and disconnected pipes were the cause of one failure of a complete sprinkler system to function in the manner normally achieved.

Jan. 5, Louisville, Ky., Enro Shirt Co., Inc. $730,000†

STORAGE OF PIECE GOODS AND FINISHED SHIRTS. A Sunday morning water-flow signal to the central station headquarters was the first indication of fire in this fully sprinklered warehouse. The 8:52 A.M. alarm brought city fire fighters who used seven 2½-inch hose streams and thirteen 1½-inch hose streams to extinguish the fire.

Evidence indicates that the fire originated in a basement joist channel adjoining a brick chimney and above a metal and asbestos shield, constructed to protect the joists above the supposedly well-arranged vent for a gas-fired steam boiler. Three basement sprinklers operated on this fire to prevent its spread into the basement. The two sprinklers adjacent to the vent pipe but shielded from the fire by the metal and asbestos protector did not fuse. This allowed the fire to pass up between the chimney and the furred-out wall into the joist space above the first story. Three sprinklers operated in the first story but had no effect on the fire in concealed joist spaces. Extinguishment was made by hose streams.

The damage to the building was low, but damage to the finished stock due to smoke and hose streams was high.

Jan. 29, Dayton, O., Varsity Bowl, Inc. $360,000†

NIGHT CLUB AND BOWLING ALLEYS. On December 12 the sprinkler system froze in the attic of an 80 ft. by 80 ft. 1-story brick, wood-joisted night club which communicated with a 28-lane 125 ft. by 160 ft. similarly constructed bowling alley. The water damage from the break was negligible, but repair was slow. Within two weeks only 25 per cent of the damaged system had been put back in service, and the remainder was left disconnected until it could be redesigned for nonfreeze operation.

On January 29, a fire started in the concealed night club attic under the shut-off sprinklers from ignition of "combustibles" close to a unit heater. The substandard clearances between the heating equipment and combustible construction had been known for over a year, but the owners did nothing to improve the condition.

The fire spread throughout the night club attic, down the open stairs to the night club proper, and on both levels attempted to spread into the bowling alley. A passing taxi driver discovered the fire and pulled the street fire alarm box at 3:16 A.M.

Thirty sprinklers held the fire from the bowling alley while the night club (118 shut-off sprinklers) was extensively damaged.

***July 23, Corbin, Ky., F. B. Heath Lumber Co., Inc., et al. $250,000**

LUMBERYARD, GROCERY WAREHOUSE. A, fire starting from an unknown cause in a lumberyard spread through plain glass windows to a sprinklered 2-story brick, wood-joisted grocery warehouse. Unfortunately the post indicator for the one-supply sprinkler system control valve had been broken off by a truck. The post indicator was not repaired but was replaced with a nonindicating curb box and key. The warehouse manager had made observations of the pressure gauges at the dry pipe valve after the repairs and found correct water pressure. He did not make drain tests, however, or he would have found that the control valve had only been cracked open. The sprinkler system had no fire department connection.

As the fire spread through the warehouse, all 306 sprinklers opened but no water discharged. Volunteer fire department personnel were slow in their response. Though the initial alarm brought three on-duty firemen with two pumpers and the six off-duty firemen were prompt, call men took over 15 minutes to assemble. By then the fire had fully involved the lumberyard and had a good hold on the warehouse.

*Fire spread to other buildings.
†Includes business interruption loss.

**These five fires are summarized in this QUARTERLY: Nashville, Tenn., page 279; Lac Beauport, Que., page 298; Bayonne, N. J., page 309; Louisville, Ky., and Dayton, Ohio on this page.

Fires in Partially Sprinklered Buildings

Of the 14 partial sprinkler systems in buildings involved in the 1958 large loss fires, two systems were not a factor in the outcome as they were not in the fire area.*

Jan. 31, Port Washington, Wisc., Wisconsin Electric Power Co. $250,000

STEAM ELECTRIC GENERATING STATION. When an operator attempted to isolate from the line hydrogen-cooled, 94,118 kva, 22 kv, generator No. 3 to provide the reduced load required at 12:43 A.M., there was no response to the control. The operator went to the switch house and attempted isolation by manually tripping out Phase A. Normally this would throw out Phases B and C automatically. Since it didn't this time, he had to climb up a flight of stairs for Phase B. As the neutral had been opened previously and Phase A and B had now been opened, the generator lost synchronism and faulted as high voltages were developed through Phase C. The unstable condition caused a fault in generator No. 4 eleven cycles later. After another eleven cycles generator No. 4 automatically isolated itself. Within 3½ minutes of the initial fault the 8 ohm neutral resistor failed. When the operator finally reached Phase C all faults were cleared.

The two neutral resistors were individually mounted in fire-resistive rooms in the basement. Each room communicated with cable alleys through openings which were protected by hollow metal swinging doors. Only one resistor was in the circuit at the time of the fault.

The heat of the overloaded resistor blew open the door to the cable alley and ignited some combustible material and stock stored in the alley. The resistor was destroyed, concrete spalled off the ceiling, a 10-foot section of the copper grounding bus vaporized, a porcelain bushing melted and a ceiling-mounted metal cable tray buckled.

The fire in the cable alley was extinguished by plant personnel using available portable extinguishing equipment. The loss figure given is the fire loss only and does not reflect a similar sized loss due to electrical breakdown.

The partial sprinkler system over the coal handling mechanism was not involved.

*Both these fires are summarized in this issue of the QUARTERLY: Battle Creek, Mich., page 277 and the fire at Port Washington, Wisc. reported on this page.

Horst Oesterwinter

Originating in an unsprinklered section being added to this hotel at Lac Beauport, P. Q., on Nov. 19, fire spread into the communicating main part of the building where it overpowered sprinklers supplied by a pressure tank. See detailed report on page 298.

Six partial sprinkler systems operated satisfactorily in that they kept fire from spreading from the non-sprinklered to the sprinklered areas.†

Jan. 31, Memphis, Tenn., Federal Compress and Warehouse Co. $323,000

COTTON WAREHOUSE. A watchman, preparing to leave these premises, saw a fire in cotton bales stored in an unsprinklered wooden shed which adjoined and separated two rows of sprinklered, 72 ft. by 85 ft., 1-story brick, wood-joisted cotton storage compartments. Openings in the walls between the sprinklered compartments and the nonsprinklered shed were protected by nonautomatic fire doors. These fire doors had been left open by the employees.

The watchman telephoned a central station supervisory service which immediately called the fire department.

In the meantime fire had spread from the wooden shed to ten of the sprinklered compartments where it was being held by 106 sprinklers. The fire department arrived, pumped into the fire department sprinkler connection to reinforce the sprinklers and then extinguished the fire in the wooden shed and in a single row of cotton bales stored therein.

Sept. 11, Portland, Ore., Waterway Terminals Co. $400,000

WHARF UNDER CONSTRUCTION. Acetylene cutting was part of the job of installation for the cargo elevators on this new 1,250-ft. enclosed wharf. A sprinkler system was being installed in the wharf shed and under the wharf but the sprinklers were only in service for a 300 foot long section at one end on Sept. 11, 1958. The fire started about the midpoint of the wharf, when a cutting spark ignited a creosoted stringer beneath the deck.

The fire spread rapidly under the deck of the wharf, defying efforts of the hose-equipped contractor's crew to halt it. The fire passed through door openings of the 4-inch-thick tongue and groove plank firestops under the wharf, as the doors had not yet been installed. Spreading up into the enclosed wharf shed through unprotected elevator openings, the fire also spread both ways over the wharf deck. The fire spread was stopped in one direction by 50 sprinklers and in the other direction by land-based fire fighters, while fireboats knocked down the fire in the involved area. The fire spread approximately 325 feet in each direction.

In six cases partial sprinkler systems were ineffective‡ In five of these fire started outside the sprinklered area; in one case, in concealed spaces.

***March 4, Calais, Me., State Theatre et al., $300,000**

THEATRE, STORES, OFFICES. While a movie was in progress a theater employee smelled smoke and traced it to the basement. A sprinkler in the basement caused the water-flow alarm in the building to ring at about the time the employee reported the fire to the theater manager. The fire department was called. Then the theater manager mounted the stage and told the audience that it really ought to leave as the sprinkler alarm was ringing. The theater was emptied rapidly and without panic.

Firemen, who were having a meeting at the time of the fire, arrived within two minutes of the alarm and found the remains of a small fire in basement storage. Their first conclusion was that the fire had been put out by one sprinkler, but they soon discovered that flames were spreading within hollow nonfirestopped spaces behind wall sheathing. Traveling through these spaces, the fire soon reached the unsprinklered attic of the otherwise sprinklered building. Because of nonfirestopped hollow sheathed construction the fire spread easily to four other stores in the block.

Investigators could not establish whether the fire originated in the basement and entered the wall space before the sprinkler operated or whether it started in the concealed wall space.

†These fires are reported in this issue of the QUARTERLY: Chattanooga, Tenn., page 249; Greenville, S. C., page 271; Tampa, Fla., page 278; Chicago, Ill., page 308; Portland, Ore., and Memphis, Tenn , this page.

*Fire spread to other buildings.

‡Five of these fires are reported in this issue of the QUARTERLY: Providence, R. I., page 239; Louisville, Ky., page 268; Calais, Me., this page; Guilford, Me., and Los Angeles, Calif., next page.

May 16, Los Angeles, Calif., Zinsco Electrical Products Co. $1,288,000†

ELECTRICAL EQUIPMENT MANUFACTURER. Fire of undetermined origin apparently broke out near a small electrical motor in the exhaust duct of a drier on the roof of this 120 ft. by 260 ft. 1-story brick, wood-joisted building. The roof-mounted drier was a gas-fired conveyor-fed type used for drying dip-painted electrical parts.

The fire was first noticed when tar began to drip down from the roof. It was then noticed that the roof over the paint-dip area had burned through. The fire department was called by telephone.

Eighteen sprinklers mounted over the painting operation in this otherwise unsprinklered building were unable to operate on the fire above the roof and were ineffective when a large amount of fire dropped down into the paints and solvents below. The central station automatic fire detection system also did not operate until the fire burned down through the roof.

Even though automatic protection had been provided inside the building, no protection was provided for roof-mounted hazardous equipment.

***June 28, Guilford, Me., Hardwood Products Co. $1,011,500†**

WOOD TONGUE DEPRESSORS, ICE CREAM SPOONS. The 30,000 sq. ft. sprinklered 1- and 2-story wooden mill and several adjoining or adjacent unsprinklered wooden warehouses were destroyed by fire that originated in an unsprinklered space beneath the first story of the mill. An electric motor in the subfloor space was the probable cause.

About 11:55 A.M. one of the Saturday morning maintenance crew was alerted to the fire by the water motor gong. Apparently the single sprinkler mounted in the subfloor area over this large motor was operating, but was shielded from the fire by the motor itself. The maintenance employee spent between 10 and 12 minutes trying to

*Fire spread to other buildings.
†Includes business interruption loss.

Wilson Studio

In Guilford, Me., fire spread through the unsprinklered sub-floor space in the otherwise sprinklered woodworking plant. See report on this page.

extinguish the fire with two 2½-gallon soda-acid extinguishers but because of the inaccessible location, he was unsuccessful. The delay was established by the fact that the maintenance employee did not sound the noon whistle until 12:10 P.M. When the whistle, which also served as a town fire alarm, continued to shriek, the fire department responded.

The fire fighters placed two streams supplied by a 6-inch dead-end main in operation. However, because of the dense smoke in the subfloor space and in the first floor they could not be used effectively. Eventually the fire burned through the flooring and entered the first story. Sprinklers that fused in this area did not control the fire, probably due to the fact that the single source water supply for sprinklers (the 6-inch dead-end main) was already being used to supply fire department hose streams.

The wooden mill building was separated from some wooden warehouses by a 50-foot-long, 3-foot-wide alley and by a 35-foot-long, 20-foot-wide alley. Someone, recognizing the severe exposure problem where there was only the 3-foot separation, had erected a 50-foot-long winged and parapeted brick fire wall with standard fire doors along this exposure. No protection was evidently thought necessary for the building where it was separated by the 20-foot-wide alley. The fire jumped the 20-foot clear space against the wind to the exposed wooden warehouse walls and destroyed the warehouses.

Private Water Supplies and Fire Pumps

In 237 of the 286 large loss building fires in 1958 there were no private water supplies or fire pumps. In 12 cases this lack of adequate private water supplies was a factor in the outcome of the fire. In 15 other fires the private water equipment available contributed to restricting the extent of the loss.

Eddy Sykes

No public or private water supplies were available for fighting fire at this machinery warehouse near Ogallala, Nebr. The fire had been burning in the unsprinklered building for some time before discovery by an outsider. **See report, page 247.**

Effective Use of Water Supplies

Feb. 20, near Klamath Falls, Ore., Car-Ad-Co Co. $313,000

SAW AND PLANING MILL. Most of this large lumbermill was well protected with twenty-two separate sprinkler systems supplied by a 50,000-gallon, elevated tank on a 100-foot trestle as a primary water supply and by a lake as a secondary water supply. The looped 6-inch and 8-inch yard water mains, fed by the tank and by an electric and three steam fire pumps with a combined rated capacity of 3,950 gpm, supplied the sprinkler systems and 23 yard hydrants.

Two wooden, dry-lumber storage sheds, covering over an acre of ground, were not sprinklered. These "east" and "west" sheds were the only buildings of size on the premises that did not have this automatic protection. Fortunately these two sheds were located approximately 500 feet from the main plant. The plant watchman on his 9:30 P.M. round entered the east storage shed at between 10:05 and 10:15 to punch his clock. He drove by the west shed about 10 minutes later as he returned to the starting point for his next hourly round. About 10:30 P.M. fire had involved the east shed. The watchman spotted the glow as he started his 10:30 round and after investigating gave the alarm. Fire destroyed both sheds and the 1,750,000 board feet of dry pine lumber stored in them.

The responding fire company called for mutual aid. Because of the distance between these sheds and the other buildings at the mill and because of the strong plant water supply, fire fighters were able to protect exposures.

Spectators jammed the narrow roads leading to the plant making it impossible for at least one pumper to get through.

Nov. 25, Geismar, La., Wyandotte Chemical Corp. $1,750,000

ETHYLENE OXIDE PLANT. A detonation occurred in the piping of a 3-story, noncombustible, open-air, recycling section of an ethylene oxide unit of the direct oxidation type. Cause of the detonation has not been released. The kerosene coolant pouring from piping was the principal source of fuel for the ensuing fire. The deluge water spray system installed in this unit was put out of commission by the detonation, but the two 2,000-gpm fire pumps taking suction from two 300,000-gallon tanks provided plenty of water for hose streams permitting effective fire control by responding firemen.

Fire Pump Failures

In 10 cases failure of fire pumps to operate properly was a factor in the fire. The 10 fire pump failures were as follows:† five pumps suffered power failure during the fire; one would not operate; one had its discharge valve closed during the fire; one was unable to be operated as the fire was in the boiler house where the pump was located; and, in the last two cases, the suction lines were inoperative, one due to the clogging of the screens and the other due to the freezing of the line.

***Aug. 17, near Council, Idaho, Boise Cascade Lumber Co., et al. $521,000**

SAW AND PLANING MILL. Fire that originated in the third story of the unsprinklered 1- to 3-story wooden mill was spreading rapidly when discovered by the watchman at 1:05 A.M. He sounded the fire whistle and stayed in the boiler house as long as possible trying to start the steam fire pump, but the rapid spreading fire entered the boiler house before the pump could be started.

With no water available for fire fighting, mill employees were helpless. Forest service portable pumps were eventually set up at the mill pond and small hose streams supplied by the pumps were used to protect exposures that were 150 feet away. But some small sheds nearer to the fire were destroyed.

The boiler house that housed the fire pump was separated from the mill by a fire wall with the two main openings equipped with double automatic fire doors. These doors apparently operated satisfactorily. However, there was a 14-in. by 3-ft. opening in the wall for the hog fuel conveyor; and it is through this opening that the fire is thought to have entered the boiler house.

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*Fire spread to other buildings.

†Five of these cases are summarized in this QUARTERLY: Cicero, Ill., page 251; Chicago, Ill., page 308; Seattle, Wash., page 315; near Council, Ida., this page; and near Coeur d'Alene, Ida., next page.

Courier-Post Photo

This fire, Feb. 18 at Camden, N. J., broke out when oil-soaked waste was ignited to thaw two 10-inch fire pump suction pipes that ran on top of the pier deck. Flames spread to the railroad car repair shop on the pier.

Water Supply Failures

The 5 water supply failures were due in 2 cases to the inadequacy of the supply, in one case to the insufficient number of yard hydrants, in another case to the fact that a low 300,000-gallon standpipe did not provide adequate pressure for hose lines, and in the fifth instance because the system had been drained for the winter to prevent freezing.

***July 28, near Coeur d'Alene, Idaho, Northwest Timber Co. $722,000†**

Wood Planing, Dry Lumber Shed, Loading Shed, Offices. It was warm (80-90 degrees) with low humidity (18 per cent), and a 20 mph breeze was blowing. If the mill owner thought of fire, it was probably only with a feeling of security because every building was sprinklered on a dry pipe system. The 6-inch loop around the sawmill and the 7-inch dead-end main to the 74,000 sq. ft. irregularly shaped planing mill were supplied from the Spokane River by two 1,000-gpm pumps, one steam driven and the other an automatic electric-driven pump. As the pump's electric supply was exposed at both the substation and at the transmission lines a gasoline engine back-up was provided in case of power failure.

Every one of the owner's control and dry pipe valves was supervised, with the recording panel located in the plant boiler room with a connection in the process of being made to the nearby central station facility.

It was about 5:30 P.M. when a board stuck in one of the planers. The tail man saw the board ignite. Shutting down the dust-collecting system, he attacked the fire with two extinguishers (one — carbon dioxide, the other a "liquid" type); but the fire spread with great speed through the building. An attempt to use a standpipe hose was abandoned as the men fled the building.

The explosively spreading fire, finding no cutoffs, baffles, division walls or draft stops to slow it, quickly involved the planing mill, jumped to the sprinklered 115 ft. by 125 ft. dry lumber sorter building 36 feet upwind, 27

*Fire spread to other buildings.
†Includes business interruption loss.

C. J. Tremblay

The water supply at the Northwest Timber Co., near Coeur d'Alene, Ida., was unable to meet the demand placed on it when all sprinklers operated almost simultaneously in several buildings. See report starting on previous page.

feet downwind to the unsprinklered 2,300 sq. ft. office building and to 17 boxcars spotted around the loading shed.

The boiler room operator must have been incredulous when he saw the ten dry valve signals from the planing mill all drop practically simultaneously, followed immediately by the dry lumber and loading shed valves.

Flying brands jumped the river and ignited brush on the other side in nine places. One of the two pumpers which responded broke its drive shaft while attempting to cross the rough terrain to the river's edge.

Though the steam fire pump worked throughout the fire, the electric fire pump was switched to the gasoline auxiliary when the transformer substation and transmission lines in the fire area were threatened and subsequently damaged. The gasoline engine overheated and had to be shut down for about one-half hour until the electric supply could be restored.

Because of the lack of division walls in the planing mill and the dusty condition conducive to flash fires, it is not surprising that the fire spread quickly throughout the building; opening sprinklers as it went. The 2,000 gpm water supply was grossly inadequate to supply all the sprinklers which would have required close to 50,000 gpm.

Nov. 19, Lac Beauport, P.Q., Hotel Manoir St. Castin $424,000

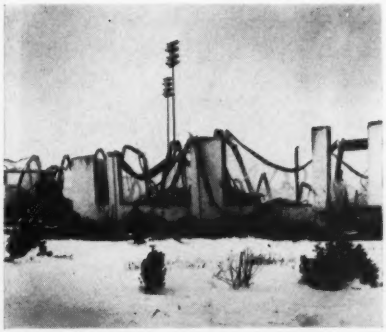
HOTEL. A wooden addition was being added to this completely sprinklered year-around hotel. The planned sprinklers for the addition had not been installed when a fire of suspicious origin broke out in the addition under construction about 6:45 P.M.

The fire was attacked with portable water extinguishers after it was discovered but the flames were too far advanced for control by this method of extinguishment. The burning force of this fire was great enough to sweep into the hotel proper and overcome the pressure tank sprinkler system which had not been designed to cope with a fire of this size.

Nov. 29, Bainbridge Twp., Ohio, Grandview Raceways, Inc. $515,000

RACETRACK CLOSED FOR SEASON. Fire, originating in a concrete block, steel-truss club house, spread through unprotected wall openings into a high concrete block, steel-framed grandstand. Discovery was not made until the caretaker saw flames coming from the club house.

A telephone call to the fire department brought pumpers from several miles to the scene. On arrival the 66,000 sq. ft. combined structure was heavily involved. The water supply was limited to use of a hydrant on the



Robert R. Runyan

end of a 12-inch dead-end main. The track's own private yard hydrant system, supplied by an 85,000-gallon gravity tank, had been emptied for the winter. No sprinkler protection had been installed.

Fire Brigades

In the 254 large loss fires where there were no private fire brigades, this absence was a factor in the outcome in 46 fires. In 8 cases the fire brigades performed their function properly.

Effective Brigade Action

March 30, Texas City, Texas, Union Carbide Chemicals Co. $2,219,000; 3 killed

Air Fractionation. Seven minutes before day workers were to be allowed on their jobs (7:15 A.M.), an explosion occurred in a covered pipe trench through which liquid oxygen was being piped to a disposal pit 100 feet away. It is theorized that a leak in the drain line caused a high oxygen concentration in the trench and that combustible waste in the trench ignited. While the cause of ignition is not definite it is thought that the leak may have been caused by external corrosion of the pipe and that the combustible waste ignited spontaneously as the liquid oxygen came in contact with it. Three men were killed in the blast which damaged the 30 ft. by 60 ft. open-sided fire-resistive oxygen building.

The plant emergency brigade, at double strength due to the impending shift change, did a fine job of clearing company streets, recovering the dead, extinguishing a small fire in the debris and supervising safety in the area.

The operators, following written procedures, had been draining liquid oxygen from a column in preparation for routine maintenance.

Ineffective Brigade Performance

In 9 cases the fire brigade did not perform properly. Three brigades were poorly trained; in 3 other cases the brigades were unable to handle the fire as it was too well advanced on discovery; in another case the brigade was off duty; and in one fire the brigade had not been supplied with the proper equipment. In the last case the brigade's fire truck could not be operated. The inoperative truck, combined with the low 300,000 gallon standpipe that did not provide adequate hydrant pressure, led to the large loss.

April 14, Gulfport, Miss., U. S. Government Property $489,500

Sisal Fiber Warehouse. Here was a fire protection engineer's dream: a noncombustible 40,000 sq. ft. sisal fiber warehouse protected with a hydraulically designed sprinkler system which was backed up with a good water supply. Fire pumps provided 3,000 gpm for extinguishment. With this equipment installed, instructions to the fire brigade were to pump into the sprinkler connection until it was possible to locate definitely the seat of the fire and only then to apply hose streams.

This dream, however, was turned into a nightmare. A fire inspector found a small smokeless glowing fire in the center of a stack of bales. He gave the alarm and then unsuccessfully attempted extinguishment with two water-type hand extinguishers. The fire brigade and nearby municipal companies arrived. Up to this point nine sprinklers had been controlling the fire; but now, ignoring instructions, the fire brigade knocked 31 links out of nearby sprinklers. Doors were hacked open and 9 roof ventilators were knocked off. Fourteen hose streams were laid and used. Fortunately, due to the strong water supply, the hose streams did not rob the sprinklers. Hoses pointed down the roof ventilator holes prevented proper smoke ventilation. Not only was the sisal soaked, but salvage was delayed, adding to the destruction.

Huntington Fire Department

This unsprinklered 350 ft. by 45 ft. 8-story flour mill at Huntington, W. Va., was heavily damaged by a Jan. 9 fire that originated in an elevator leg that terminated in the third story milling department. The bucket-type elevator had become choked and since it was not equipped with a suitable shut-down device, friction at the head pulley burned through the belt. Burning ends of the belt fell into the elevator leg where an intense fire developed. Flames burst out of the head of the leg and ignited three other combustible elevator heads.

Employees attacked the Class A fire with seven portable extinguishers suitable for use on a Class B or C fire and also obtained a standpipe hose only to discover that it would not fit the standpipe connection. Accompanied by several minor dust explosions, the fire spread rapidly through the upper stories.

Standpipe and Hose Systems

In 209 of the large loss building fires no hose or standpipe systems were present. Of the 51 buildings where standpipes and hose were present, 8 systems were not a factor in the outcome of the fire as no one was present to operate the systems. Fourteen systems were used to extinguish or assist in control of the fires.

Twenty-nine systems failed to operate or be operated properly.† In 12 instances the fire was too far along on discovery for the hose systems to be effective. In 4 cases there was a poor or inadequate supply of water; in 3 cases the fire spread too fast for effective use of the system; in 2 cases the employees did not think to use the equipment; standpipes were too far from the fire in 2 cases; in 1 case there was no nozzle on the hose; in another the threads on the standpipe did not match the threads on the hose: the lack of a fire department connection was a handicap in one fire and in another instance, the standpipe system was being altered when the fire occurred. The last 2 cases of unsatisfactory performance were occasioned by the attempted use of hose streams on materials that were not subject to water extinguishment.

†Nine of these fires are summarized in this QUARTERLY: Orange, Tex., page 237; East Chicago, Ind., page 270; New York, N. Y., page 276; Tampa, Fla., page 278; Portland, Ore., page 293; Coeur d'Alene, Ida., page 297; Los Angeles, Calif., page 317; Two other fires where standpipe and hose systems were not effective are reported on the following page.

Wide World

One of the factors preventing early control of this flour mill fire at Franklin, Tenn., was the lack of a nozzle on a standpipe hose. See report on next page.

Williamsport Sun-Gazette

The Reading Railroad car shops at Williamsport, Pa., were destroyed by fire that started in the locker room. The fire burned for some time in the unsprinklered room before discovery by employees, and had made so much headway that they had to leave the building before a standpipe hose could be placed in operation. The building was completely involved by the time the fire department arrived. Fire fighting consisted primarily of protecting exposures.

*Jan. 8, Franklin, Tenn., Lillie Mills $410,000

FLOUR MILL. Fire that destroyed this unsprinklered 12,000 sq. ft., 5-story brick, wood-joisted mill originated in a raised section on the fourth floor. Employees discovered the fire soon after it started and attempted to place a 1¼-inch standpipe hose in operation as the alarm was being called in. This attempt failed, however, when it was found that the hose had no nozzle. The dusty atmosphere, the combustibility of the building itself, the open stairways and an unprotected conveyor opening allowed the fire to spread down to the first floor. Public fire fighters arrived promptly, but were prevented from saving the building due to the large area already involved, combined with the poor water supply from the city mains. The water system was hardly able to supply two pumpers even though others were available from as far away as 28 miles.

*Fire spread to other buildings.

Oct. 29, Sault Ste. Marie, Ont., Mannesman Tube Co. Ltd. $400,000

MACHINERY, MOTOR AND MILL SUPPLY WAREHOUSE. Radiant heat from an electric heater in the office of this unoccupied, unsprinklered, 7965 sq. ft. 1-story wooden storage shed, may have ignited combustible waste material which in turn ignited the combustible fiberboard walls.

Employees had been in the shed about 7 P.M., the watchman at 7:15 P.M. No one noted anything amiss. At 7:25 P.M. a neighbor telephoned the plant to say that flames were visible in the shed.

Employees tried to stretch a plant fire hose to the building, but the attempt was unsuccessful. The fire spread easily along the combustible fiberboard finish of the unsprinklered and undivided building. The loss of this inexpensive ex-contractor's shed was negligible in contrast to the loss of the highly valued contents.

Portable Fire Extinguishers

In the 286 large loss building fires of 1958, 24 occurred in buildings without portable fire extinguishers. There were no data on extinguishers in 23 cases. In 239 cases portable fire extinguishers were present. In 189 of these fire extinguishers were not a factor, either because the buildings were unoccupied at the time of the fire, or because the extinguishers were not used for one reason or another. In 5 of the remaining 50 cases extinguishers performed their function satisfactorily.

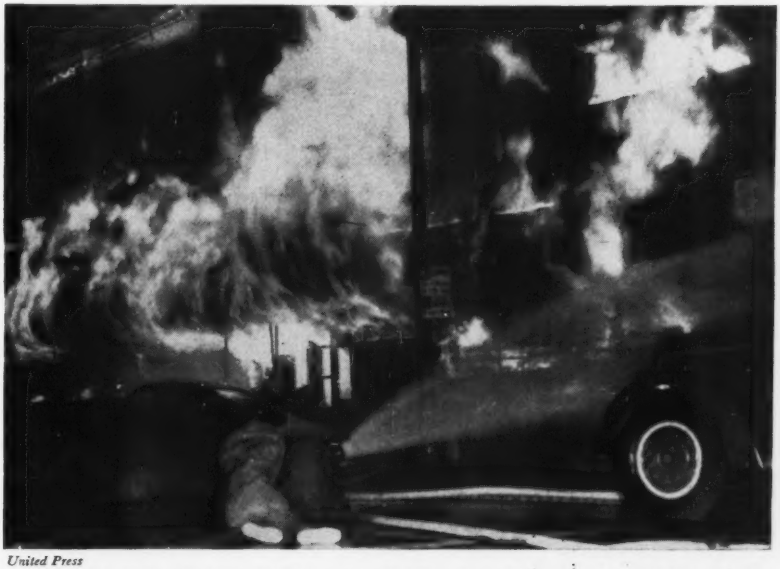
Satisfactory Extinguisher Usage

Aug. 22, Baton Rouge, La., Kaiser Aluminum and Chemical Corp. $250,000

POWER PLANT. Just after midnight a 2-inch 80 psig oil line broke at a weld and sprayed lubricating oil over adjacent steam pipes and fittings in the basement of this plant's 135 ft. by 240 ft. fire-resistive power house. The fire was located so that it prevented shutdown of the lubricating oil pump. The pump continued to pour oil on the fire, therefore, until the pump power supply could be interrupted. The fire was controlled by the plant fire brigade using twenty-five 15-pound carbon dioxide and eight 30-pound dry chemical extinguishers, and by five 2½-inch fire streams from the mutual aid fire departments responding on a prearranged plan. Damage was confined to two generators and the power house floor.

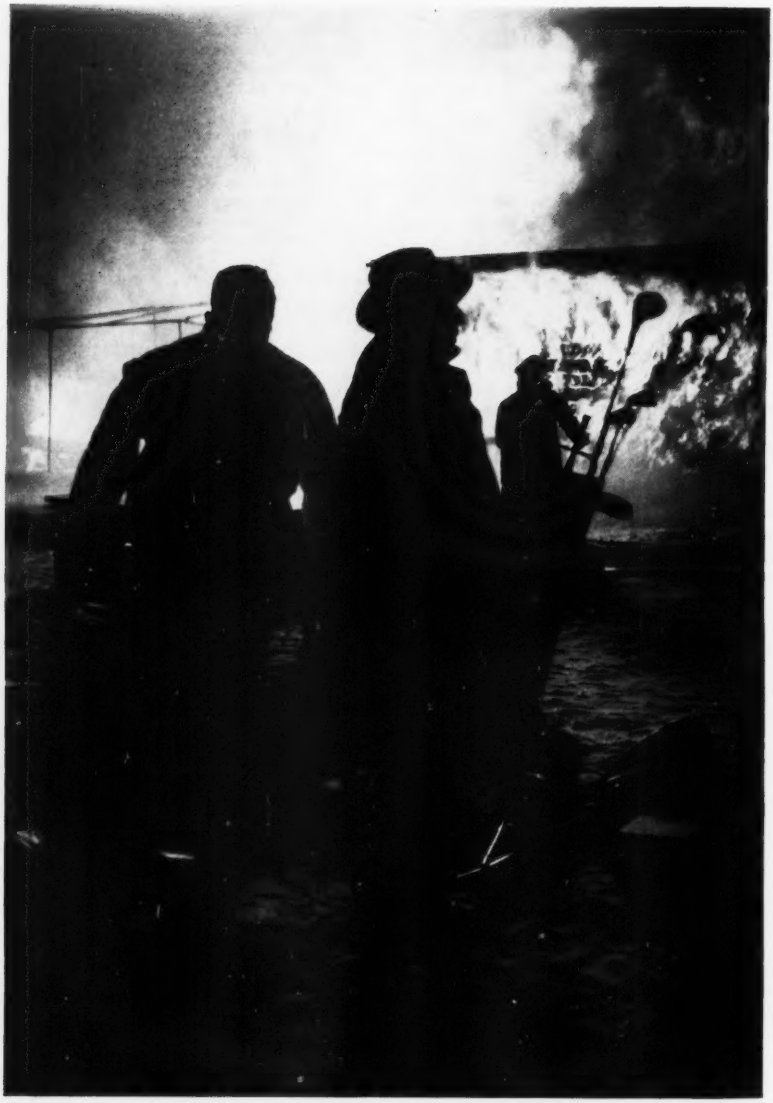
Ineffective Extinguisher Usage

In 45 cases the use of portable fire extinguishers was not successful in controlling the fires which ultimately resulted in large losses. Most frequently a combination of circumstances is responsible for such experience but the principal factors appear to be: (1) fire too advanced on discovery for effective control by extinguishers (in 14 large loss fires this condition was evident); (2) use of the wrong type of extinguishers



United Press

The Oct. 14 Los Angeles, Calif., supermarket fire shown here was confined to a pile of cartons when discovered. Use of a Class B-C extinguisher on the Class A fire was ineffective. **See report on page 305.**



Flint Journal

While 150 members were witnessing the awarding of golf trophies in the club dining room, fire broke out in the men's locker room of the Flint Country Club at Flint, Mich. The fire had been burning an estimated 15 minutes before discovery by an employee, by which time it had made so much headway that three 2½-gallon soda-acid extinguishers were ineffective. The fire department apparently was summoned promptly; but due to the poor water supply from a dead-end 6-inch main and the inaccessibility of the water in the country club lake due to ice, firemen were unable to save the unsprinklered wooden structure.

for the class of fire involved (true in 11 of the large loss fires); (3) use of extinguishers of inadequate capacity (evident in 8 of the large loss fires); (4) inadequate number of extinguishers available; (5) improper technique of usage; (6) extinguishers available empty or inoperative at time of emergency; and (7) failure to recognize rekindling hazard after fires appeared extinguished.

Oct. 14, Los Angeles, Calif., Hiram's Market, Inc. $650,000†

SUPERMARKET. Fire of undetermined cause broke out in a rear warehouse section of this unsprinklered 20,700 sq. ft. 1- and 2-story stuccoclad wooden supermarket. The store's burglar alarm indicated trouble and brought two central station men to the scene. They, with the night maintenance men, found the fire progressing in a pile of cardboard cartons. An attempt was made to extinguish the Class A fire with a Class B-C carbon dioxide extinguisher. The attempt was unsuccessful. The fire was spreading fairly rapidly by the time the central station men could call their headquarters which in turn alerted the fire department. As there were no sprinklers or fire division walls, the fire involved the entire building before the arrival of the fire department.

May 9, near Knoxville, Tenn., C'est Bon $334,000†

RESTAURANT. A fire broke out in the combustible fiberboard ceiling near a vent to a charcoal broiler. An employee attacked the fire and thought he had it out, but a while later (estimates vary from 30 to 105 minutes) the fire broke out again in the same place and this time spread with great rapidity.

The 625 guests were asked to leave the swanky night club which occupied a 150 ft. by 200 ft. 1-story concrete block, wood-joisted building as the flames enveloped the kitchen. The guests left with little confusion, although, at first, some mistook the waitresses' instructions to "get out of here" for "we're out of beer."

†Includes business interruption loss.

Four fire departments responded to the telephoned alarm with 6 pumpers and 16 men. As the pumper tanks were the only water supply available, the building was destroyed.

Summary

The foregoing examples should make quite clear the point that merely the *provision* of private fire protection equipment is not adequate to prevent large loss fires. The proper *maintenance*, and *operation* of this equipment are necessary corollaries.

Most property owners learn the importance of providing strong private fire protection from the experience of others. The owner of Frankie's Market at Lodi, N. J., failed to profit from his own experience in 1957 and suffered a second large loss fire within six months.

Jan. 10, Lodi, N. J., Frankie's Market $600,000

FOOD, CLOTHING, APPLIANCE SALES CONCESSIONS

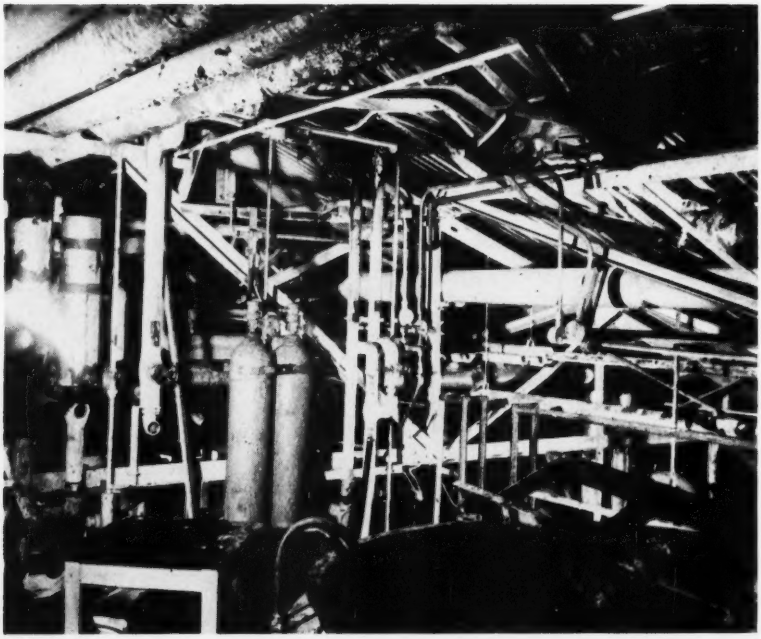
The 1957 large loss analysis included (see April QUARTERLY, 1958, page 261) an arson fire which destroyed an undivided, unsprinklered 120 ft. by 528 ft. building under the following heading:

"July 29, Lodi, N. J., Frankie's Market $500,000."

Following this fire, the building was rebuilt as a high 120 ft. by 528 ft., 1-story, cinder-block, wood-joist and truss roof structure. As previously, the building had no fire walls but it has been reported that the owner was considering the installation of automatic sprinkler protection. The market was reopened on Oct. 10, 1957 but, at the time of the fire, sprinklers were still under consideration.

The watchman left the building at 6:30 A.M. with everything all right but on his return at 6:50 A.M., he found the entire underside of the wooden roof ablaze. He telephoned the alarm at 7:03 A.M. When fire fighters arrived, the wooden partitions between concessions and the canvas awnings over the concessions were also ablaze.

The fire was thought to have originated at one of the gas-fired heaters.



Kalamazoo Gazette

An explosion at this drug plant near Kalamazoo, Mich., demonstrated the fact that fire and explosion prevention efforts must not be relaxed despite the presence of strong fire protection facilities. See report on this page.

The following explosion in a drug factory is cited to illustrate the fact that high value properties with excellent private fire protection are still subject to a serious fire loss when explosions occur, possibly due to employee error, or when there is a relaxation of some phase of the plant's private fire protection program.

Jan. 15, near Kalamazoo, Mich., The Upjohn Co. $290,000

DRUG PILOT PLANT. It was 7:30 P.M. Wednesday evening. Two men were periodically adding a caustic solution to 600 or 700 gallons of benzene under agitation in a 1,600-gallon enclosed vat. The vat, protected by a fixed carbon dioxide system, was located in a sprinklered 60 ft. by 150 ft., 1-story steel on steel truss building. The vat ruptured after an unexplained buildup of pressure, driving the lid up through the roof.

The fixed carbon dioxide system was damaged and did not extinguish the flammable liquid fire that broke out in the vat area. Eight sprinklers operated while a worker who had been at another tank rescued the two badly burned men. These 8 sprinklers held the fire in check. The plant fire brigade, utilizing four 20-pound and one 50-pound dry chemical extinguishers plus standpipe hose and hydrant lines, extinguished the fire. Public fire fighters from nearby towns responded on the plant's prompt alarm but only had to stand by in case exposure protection should be needed.

The rupture damage caused most of the loss in the building and in the process equipment. The proper functioning of private fire protection devices and the fire brigade limited fire damage to the vat, the chemicals involved and some nearby process equipment.

1958 Large Loss Building Fires —

Public Fire Protection

Fire departments in the U. S. and Canada vary from city to city as to their training, equipment and operational procedures as well as in manpower allotments, organizational policies and financial inducements. Each year thousands of fires are handled by adequately trained and properly equipped fire fighters. Unfortunately, also each year there are large building fires, some of which are the direct result of faulty fire fighting practices. No criticism of any specific fire department is intended by this report. On the contrary, these stories are used to illustrate the questionable practices in the hope that they will be entirely eliminated from present-day fire department procedure.

This section will also illustrate some of the hazards that face the fire service, so that a better understanding of the difficulties and limitations of manual fire extinguishment will result.

Sprinkler Systems

The role sprinkler systems play in connection with fire department handling of fires in buildings so equipped is of great importance since most sprinklered buildings involve either a high life safety hazard or a high property damage possibility. By failing to appreciate the value and importance of maintaining effective water supplies to operating sprinklers, fire fighters can be responsible for permitting fires within

Democrat and Chronicle

The three upper stories of this 5-story multiple occupancy manufacturing building at Rochester, N. Y., were in flames when firemen responded to an alarm at 11:44 P.M. Severe cold, strong winds and a snowstorm hampered fire fighting. Sprinkler control valves were closed. **See summary on page 272.**

sprinklered properties to spread beyond sprinkler control. The most common mistake is the practice of diverting the water needed for sprinkler operation to hose streams, instead of reinforcing the sprinkler system through the use of fire department connections to such systems.

The following case is an example of excellent fire department handling of a fire in a sprinklered building.

***May 21, Chicago, Ill., Majestic Wood Carving Co. $262,500†**

NOVELTY FURNITURE MANUFACTURING. Good fire department operations are illustrated in this evening fire. A watchman promptly discovered the fire burning in lumber piles under an unsprinklered wooden, metalclad canopy that covered part of the 10,000 sq. ft. lumber storage yard which adjoined this sprinklered 30,475 sq. ft. 1- to 3-story brick, wood-joisted woodworking plant. The sprinkler system was supplied by a 20,700-gallon roof-mounted gravity tank and an automatic 1,000 gpm electric fire pump taking suction from a 53,000-gallon underground reservoir.

The fire must have spread rapidly through the lumber, as the first arriving fire companies found the yard heavily involved. One of the first engines immediately attached two 3-inch lines to the fire department connection of the sprinkler system in the already seriously exposed building and kept pressure on the system. This procedure proved its worth as the pumper supplemented the electric fire pump's water supply until the electric power for the pump was interrupted by the fire. The pumper then took over the total job of supplying the sprinklers.

Even though the wooden window frames of the sprinklered building were on fire when the first companies arrived, the reinforced sprinkler water supply was able to furnish water for the 98 sprinklers that opened. These sprinklers prevented extension of the fire on each of the three floors.

Heavily damaged along with most of the yard lumber were two unsprinklered kiln buildings. One was brick, wood-joisted, the other fire-resistive in its construction.

Even though the fire department originally responded to the telephoned alarm of

*Fire spread to other buildings.
†Includes business interruption loss.

Warren C. Zapp

The ladder truck shown in the photo was damaged at the Bayonne, N. J., paper box factory fire before it could be driven to safety. See report on the next page.

fire with a "still" alarm response, calls for help were made rapidly enough so the delay in the arrival of extra apparatus probably was not a factor. Four extra alarms were sounded within 8 minutes of the original alarm.

The following case shows what happens when the water needs of a sprinkler system are ignored and hose streams are placed in operation without any effort to reinforce the sprinkler water supply.

Nov. 14, Bayonne, N. J., Garden State Container Corp. $1,400,000

PAPER BOX MANUFACTURE. A one supply sprinkler system failed to prevent the destruction of a 150 ft. by 200 ft., 1-story brick, wood- and steel-joisted building housing a paper carton and cardboard fabricator. An 8-inch dead end pipe ran in front of the plant and then three hundred feet to connect to an 8-inch grid and to a 30-inch main. Two hydrants and the sprinkler connection were served by this pipe.

About 3 A.M. an employee was preparing to bale paper cuttings. He opened the box-shaped paper cutting collector and reached in with a long metal hook. As he pulled down the paper there was a "puff" and fire spread down through the paper and dust that was falling to the floor. The flame front spread rapidly on the dust- and lint-covered structural members. The baler operator in his haste to escape dropped into the seven-foot-deep, grave-sized baler hole in the floor. His screams for help were heard by fellow employees who were able to return under cover of the cooling sprinkler discharge to rescue him. The discharging sprinklers also gave the alarm of fire through central-station-supervision to the fire department.

When the fire department arrived there is some question as to whether the fire was or wasn't being held by the sprinkler system. In any case it was very close. The first-in pumper connected to one of the hydrants off the 8-inch dead end underground line but did not connect to the fire department connection and bolster the sprinkler supply. The Fire Chief reports that the danger of wall collapse prevented his tieing into the sprinkler connection. When the water supply to sprinklers was weakened by this pumping, the fire began to increase in intensity. As the flames roared through the plant, an effort was made to save several of the exposed pieces of fire equipment. One pumper from a nearby town had to be driven off while still attached to a hydrant. The hydrant was ripped from the ground. The rapidly spreading fire quickly and completely destroyed this fully sprinklered building.

Telegraph Photo Engraving Co.

Lack of private fire protection resulted in delayed discovery of this printing plant fire at Dixon, Ill. on Feb. 16. Other factors contributing to the total loss were weak manpower on initial response, delay in response due to simultaneous alarms and poor water supply by a 4-inch dead-end main.

Alarm Response

The adequacy of fire department response to the alarm of fire is an important consideration in the study of large loss fires. In the last few years failure to assign an adequate number of men to first alarm response apparatus coupled with failure to call promptly extra help when needed has resulted in the old problem of "too little — too late." This is just as dangerous as delayed initial discovery or delayed alarm.

The advent of radio equipped apparatus has made it possible to provide a full, effective response on both first and subsequent alarms; but many communities, even those with radio, fail to make full use of their facilities.

Jan. 1, Chicago, Ill., Abandoned Warehouse $250,000

VACANT COLD STORAGE WAREHOUSE. At 7:10 A.M. a telephoned alarm of a building fire brought a partial box assignment of one engine, one ladder and one squad truck. This crew attempted to fight the third-floor fire in the 75 ft. by 125 ft., 7-story brick, wood-joisted vacant cold storage warehouse until 7:19 A.M. when a call for help was made. At this time the rest of the normal first box alarm assignment was dispatched.

The fire, supposedly started by a vagrant, fed on cork- and wood-shaving insulation and spread up through the building.

At 7:57 A.M. five engines and two ladders plus additional equipment were called on the second alarm. The third alarm at 8:19 A.M. brought five more engines and another ladder plus other equipment. The fourth alarm followed about an hour later and the fifth two hours later.

Blank walls, extreme cold and subdivision of the interior hampered fire fighters. During the 89 hours of fire fighting that followed, 3,000 gallons of gasoline were used by the pumping equipment to throw 33,000,000 gallons of water into the building, enough water to fill completely the building over five times.

Dan Behnke

This fire in an abandoned warehouse on Jan. 1 in Chicago, Ill., illustrates the difficulty of fighting a fire in a practically windowless building. Five additional alarms were struck during the next four hours and 13 minutes following the first telephoned alarm. See report on this page.

Newcomerstown News

Absence of automatic sprinkler protection, delayed discovery by the watchman-fireman and long running distance for the town fire department were the principal reasons for destruction of this brick works near Newcomerstown, Ohio. See report on this page.

In 39 cases time element in the response of the fire department was a factor in the spread of fire. In 29 of these cases the running distance was exceptionally long, in 5 cases the time delay was due to simultaneous alarms. In 3 cases response was delayed by traffic congestion or parked automobiles and in 2 cases by railroad crossings.

July 13, Rimouski, P. Q., Quebecair, Inc. $1,408,500

AIRCRAFT HANGAR. An employee reporting for work about 7:30 A.M. spotted a fire near the roof of a 1-story lean-to attached to this large wooden, steel-framed hangar. The hangar held five DC-3's and also housed a passenger terminal and a repair shop for aircraft as well. The employee reported the fire to the watchman who telephoned the fire department. By the time firemen traveled the 8 miles to the airfield and found only one hydrant 700 feet from the building, there was little to do but protect exposures.

May 9, near Newcomerstown, Ohio, Goshen Brick and Clay Corp. $433,000†

BRICK AND TILE WORKS. A cutting torch used three hours before the discovery of this fire may have been its cause. In any case the kiln fireman, who did not make regular rounds but did serve as watchman, discovered the fire in progress in this unsprinklered 15,000 sq. ft. 1- to 3-story brick, wood-joisted brick works about 6:40 P.M. He called the town fire department. The town police took the call and radioed it to the fire department which was out on a training session a few blocks from the station. The men began their 12 minute run immediately with a full crew on hand. Even though a large pond was available for water, the fire was so advanced on arrival that extinguishment was not made.

***Jan. 5, Madison, Wisc., Multiple Gas Explosion $285,500; 2 killed**

HARDWARE STORE, AUTO BODY SHOP, DWELLINGS. About 11:38 P.M. a pressure regulator between a 130-pound gas feed main and an 8.5-pound distribution main failed in the open position, allowing high pressure gas to rush into the distribution mains. Gas safety relief valves in the system began to try to relieve the pressure. Gas found its way out of a leaking corroded service pipe under the floor of an auto body shop. Gas accumulated within the shop where it exploded about 12:05 A.M. causing fire and severe building damage. In an industrial plant a quick-thinking watchman shut the gas valve before an explosion occurred. He had found gas escaping in the regulator and meter location.

Meanwhile in another section of town a 48 sq. in., graphitized failure in a 10-inch distribution main was blown out by the pressure increase and gas began to fill the surrounding storm drains and buildings. An

†Includes business interruption loss.

*Fire spread to other buildings.

Glen Perrin

The largest number of fire fighters at the scene of this $420,000 Nampa, Idaho, fire at any one time was 19. Evacuation of hotel guests was the principal concern of fire fighters during the early stages of the fire. See report on this page.

explosion which followed wrecked a dwelling and a hardware store while the ensuing fire destroyed a 3-story mercantile-apartment building. The woman resident of the dwelling was killed outright while her husband died shortly thereafter in the hospital.

The fire fighting, hampered by street storm drain fires and the large buildings involved, took all available men and apparatus. It is indeed fortunate 1) that the watchman was able to shut off the gas in the industrial plant, 2) that a skeleton crew of firemen could handle the first explosion and blaze, releasing others for the big battle at the block fire, and 3) that the block involved was accessible from all sides. Had any of these factors been different, a much more serious situation could have developed.

Manpower

Fire Department manpower deficiencies were noted in 25 fires; twelve due to inadequately trained fire fighters, 9 to insufficient manpower and 4 to organizational failures which resulted in failure of the department to bring its full force to bear on the fire.

***Jan. 8, Nampa, Idaho, Stone Poultry Co., et al. $420,000**

Poultry Processing, Furniture Store, Hotel. Fire, apparently starting on the first floor of this 80 ft. by 140 ft. 1- and 2-story brick, wood-joisted building, spread through plain glass windows to an 80 ft. by 130 ft. 2- and 3-story brick, wood-joisted furniture store and hotel. The fire was discovered by the hotel manager who telephoned the alarm at 4:01 A.M.

The fire department responded with 9 on duty men. Initial fire control operations were delayed when men from the already inadequate response had to be used to evacuate the hotel occupants. The fire department was forced to give up interior fire fighting soon after the hotel was cleared. Eventually 19 firemen were working at the fire. Fortunately an impending breakdown of one of the three pumpers was noticed before it actually occurred, and a reserve pump was able to replace this piece of apparatus before it lost its fire fighting ability. Heavy fog and 15 degree temperature further hampered effective fire fighting.

*Fire spread to other buildings.

Feb. 16, Jackson, Mich., Moose Lodge $391,000

CITY CLUB, MERCANTILES. The chief of this 83-man department had to withdraw his 100-foot ladder truck from service in order to use his high pressure pumper at the critical first stages of the fire due to the inadequate personnel on the initial response. The chief indicated in a newspaper release that the department was short a recommended 66 men. There were 30 men on duty at the time of the alarm (3:08 A.M.) until all off-duty men and those on leave were called back. At the height of the fire 78 men were at the fire and operating five pumpers, two ladders and the high pressure unit.

The fire started from a defect in a fluorescent night light fixture mounted on the ceiling of a first story loan company office. By spreading through a joist channel to the nonfirestopped wall, the fire had a good start before it was discovered by an outsider at 3:08 A.M.

Equipment

The following equipment deficiencies were reported by the fire chiefs as being a factor in 67 fires. Thirty-four reported lack of or insufficient aerial ladders, 22 complained of inadequate pumper capacity, 6 noted the need for special service equipment and 5 reported equipment breakdown at the fire scene.

Water Supply

Inadequate water supply was a factor in 92 fires. In 53 cases the fire department reported the need for more water. In 20 cases there was no public water supply; in 12 cases there was no "other-than-public" water supply and in 4 cases the "other-than-public" water supply was inaccessible for fire department use. In 3 cases the water demand to serve both manual fire fighting and sprinkler needs was inadequate.

June 8, near Monon, Ind., Monon Crushed Stone Co., Inc. $341,000

STONE CRUSHING. During an evening electrical storm accompanied by heavy rains a lightning bolt hit the wooden upper portion of the high 1-story stone crusher bins. These

J. Shaffstall

Weak fire department manpower and equipment had much to do with the total destruction of this foundry at Bucyrus, Ohio on Dec. 17. First alarm response consisted of one pumper and three men. The second alarm response consisted of a pumper and two men. Within 30 minutes of the first alarm the total manpower consisting of 10 paid and 14 call men had responded. Spectators were also used.

F. D. Marshall, Jr.

Firemen responding to this supermarket fire outside Jacksonville, Fla. on May 1st were severely limited in what they could do by lack of water. The only water available was relayed from a creek 2,400 ft. away by pumpers through a 2½-inch hose and water carried to the scene in eight tank trucks.

Aldo Merusi

For years the Rutland, Vt., fire department had tried without success to get the proprietors of this sawmill to provide a pumper access to a 12,000,000-gallon pond at the site. Delayed discovery and lack of an adequate water supply prevented saving the mill.

bins were not equipped with lightning rod protection and the strike resulted in an immediate fire. The incident was witnessed by three volunteer fire fighters returning from a firemen's convention. They telephoned the alarm.

While the storm caused this fire, it also had a beneficial effect since the crusher parking lot was rain-flooded. The flooded parking lot furnished all the water needed for the four pumpers which responded. Though the unsprinklered wooden crusher and bins were destroyed several surrounding buildings and the transformers were saved.

A discussion of water supply would not be complete without an example of a good fire department's ability to utilize a modern water supply.

***May 20, Seattle, Wash., Seattle Cedar Lumber Mfg. Co. $2,000,000**

LUMBERMILL AND YARD. This 9 acre, 350 ft. by 1,000 ft., mostly wooden cedar mill had a 2½-acre lumber storage area. Much of the plant and all of the storage was located on piles over the water of a navigational channel. The storage area was loaded with 7,000,000 board feet of cedar lumber, "stickered" for drying in 50-ft.-high piles.

*Fire spread to other buildings.

The fire originated in one of the steam-heated wooden drying kilns. Automatic sprinkler equipment held the fire until after the fire department arrived. For some reason an employee then shut off the sprinklers. The sprinklers were only shut off for a few minutes, but in this time the fire burst from the kiln and raced along in the concealed under floor spaces and through the kiln shed to the outside lumber storage.

Though the fire was accessible to land forces from only one side, 76 hose streams were brought to bear on the threatening conflagration with the help of Seattle's newly developed "Hanson" distributor. The importance of this portable, high pressure, six outlet hydrant cannot be overestimated. The excellent city water supply (125 pounds static, 85 psi residual at 19,000 gpm flowing), and the support from the water side of the fire by a strong fireboat and auxiliary marine equipment, led to the successful extinguishment of the fire. The loss was approximately 40 per cent of the plant which could easily have been totally destroyed.

The Daily Nugget

Poor water supplies, too few pumpers and lack of ladder trucks complicated fire fighting at this parochial school fire at Sturgeon Falls, Ont. on Nov. 11.

Hydrants

At the scene of 27 of the 1958 large loss fires, fire chiefs reported there were not enough hydrants available. In 4 additional cases the hydrants were frozen or defective, and in 3 others the hydrants were not usable as they were too close to the involved building.

***Feb. 9, Jacobus, Pa., Bruce V. Smith's Shopping Center, et al. $254,000**

DEPARTMENT STORE, DWELLINGS, POST OFFICE. With the temperature at minus 2°F., this Sunday morning fire caused considerable difficulty for fire fighters. Originating from defective wiring in the concealed ceiling space over the first floor furniture department of this 120 ft. by 150 ft. 2-story wooden building, the fire spread undetected for several hours. Once it burned through the ceiling that concealed it, it was spotted by a passing motorist.

The initially responding fire company found the two nearest hydrants frozen shut. Some of the seven fire departments responding to mutual aid calls took up positions at nearby natural-water sources, as the town's 160,000-gallon water tank was pumped dry before the fire was under control.

The fire spread to a 2-story brick dwelling and a 2½-story wooden bottled gas distributor.

Hazards of Fire Fighting

One or more of the following hazards to manual fire fighting was a factor in each of 187 fires: heavy smoke (64); high winds (36); blank walls impeding access (33); explosion during fire (29); extreme cold, ice, or snow (27); congested buildings impeding access (18); explosion preceding fire (12); body of

*Fire spread to other buildings.

Oregon State Fire Marshal

Basement fires are the most difficult and dangerous to fight in the opinion of most fire fighters. The Elks' Club fire of Dec. 11 at Eugene, Ore., (see report on page 262) originated in the basement and because of absence of sprinklers and delayed discovery spread up an open stairway and a dumb-waiter shaft to upper stories of the 2-story building. Damage to a telephone cable in the basement of the club, put telephones out of order in neighboring building. About 15 minutes later the alarm was radioed by a passing patrolman. There is no explanation why those who discovered the fire did not use a fire alarm box located across the street.

water impeding access (12); no basement entrance impeding access (11); height of building impeding access (10); toxic gases and vapors (8); railroad tracks impeding access (7); explosion at start of fire (6); barred windows impeding access (6); locked doors impeding access (5); yard storage impeding access (4); leaking gas mains (4); flowing flammable liquids (4).

Jan. 22, Los Angeles, Calif., Solnit Shoe Co. $782,500†

WHOLESALE SHOE WAREHOUSE. A smoky fire, originating in cardboard cartons of shoes stacked on the second floor of this 50 ft. by 120 ft. 5-story fire-resistive building, gave a tough battle before succumbing to manual fire fighting efforts.

The first problem for fire fighters was created by the employee who discovered the fire. He attempted to extinguish it with a standpipe hose, but not until he failed due to dense smoke and high heat did he call for help. It was then that another employee called the fire department. This delayed first alarm was the beginning of a series of nine alarms.

The second problem was that the building sprinklers were confined to the basement. No automatic sprinklers were provided for the upper floors. This made it necessary to work through the smoke and heat to stop fire spread and extinguish the fire itself.

The third problem was smoke and fire spread. Extending up through the freight elevator shaft, due to the failure of the elevator fire doors to operate, the smoke and fire spread out in upper floors. Ventilation in this building was extremely difficult, even though there were many windows, as most of these windows were blocked by cartons of shoes.

†Includes business interruption loss.

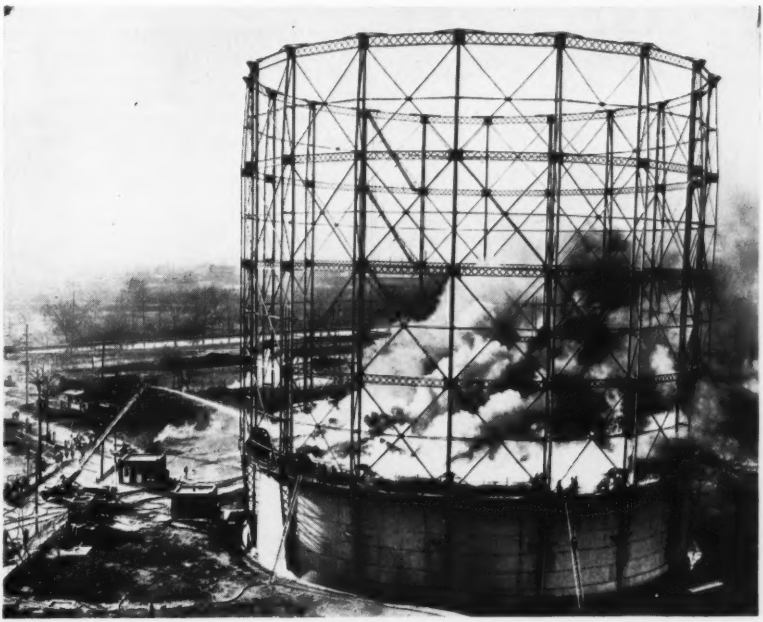
Milwaukee Journal

Responding to a basement fire in this multiple occupancy mercantile building in Milwaukee, Wis., firemen found the building charged with smoke and heat on Feb. 10. They were able to enter the basement briefly but due to the punishing conditions were soon forced outside. As they were leaving a fire gas explosion injured several men. Fire immediately enveloped the unsprinklered 2-story building.

Los Angeles Times

The fire fighting problems illustrated by this photo would not have materialized had the building been completely sprinklered (sprinklers in basement only), had the elevator shaft been properly enclosed and had the employee who discovered the fire notified the fire department at once. See report of Los Angeles, Calif., wholesale shoe warehouse fire on the previous page.

Large Loss Fires Not In Buildings



Indianapolis Times

One of the large loss fires in 1958 not involving a building occurred at a gasometer in Indianapolis, Ind. Gas was ignited by friction sparks when the roof failed. See report on this page.

There were 5 large loss fires involving property outside of buildings, other than forest or transportation fires. These 5 fires caused 3 deaths and $10,710,000 property damage. Of the 2 that occurred in oil refineries, one was the largest other-than-aircraft* fire of the year in terms of property damage ($9,000,000). One involved an outdoor transformer at an electrical power generating station. One was a gasometer. The fifth fire occurred when an earth-moving machine struck and broke a 12-inch gas transmission line.

*See report of B-52 fire at Ellsworth Air Force Base, page 326.

Jan. 12, Indianapolis, Ind., Citizens Gas and Coke Utility Company $600,000

GASOMETER. Failure of a large section of the metal crown roof of a 4-lift 3,000,000 cubic foot, 180-foot diameter gas holder released gas which immediately ignited. Friction sparks caused by the tearing of the roof plates were a possible cause of ignition.

Flames extended several hundred feet above the tank as the 2,500,000 cubic feet of gas that were in the holder under 6 ounces of pressure were quickly consumed. The lifts telescoped as the gas escaped and soon after firemen arrived no more gas remained to be burned and the fire thereafter was confined to oil and tar residue in the bottom and on the inside walls of the tank. The public fire department extinguished the fire with water spray and foam.

The steel plates of the crown roof ranged from ⅜ inch to ⅛ inch in thickness. Corrosion of the inner surface of the roof due to exposure to rust-producing impurities in manufactured gas was the most probable cause of the roof failure. Another important factor was the fact that when the tank was inflated the roof supported the weight of the telescoping sides.

Feb. 15, Alma, Mich., Leonard Refineries, Inc. $500,000; 1 killed

BUTANE STORAGE TANK. Overpressure of this "80 type" butane container caused the horizontal 500-barrel tank to split at the end as well as longitudinally. The released contents drifted across the refinery yard as a visible "fog." The "fog" ignited when it reached a source of ignition in the powerhouse 350 feet away. A severe fire resulted which killed one man and burned four others.

The overpressure was apparently the result of inadequate venting capacity.

May 22, Signal Hill, Calif., Hancock Oil Compdny $9,000,000; 2 killed

PETROLEUM REFINERY. A violent steam induced oil froth wave, which was ignited by one of many ignition sources in its path, covered 27 of the 33 acres of the Hancock Oil Company refinery. Thirteen of approximately 40 major tanks suffered extensive or total destruction. The froth wave issued from a viscous, residual oil storage tank of 80,000-barrel capacity filled with about 50,000 barrels of the product. Two plant employees were killed when caught in the wave of burning oil froth. Eighteen fire fighters suffered minor injuries. The loss by fire to the refinery and adjacent property and the smoke and soot damage to other property has been estimated at approximately $9,000,000. The cause of the steam explosion is being investigated; either water was pumped into the tank by mistake or a layer of water in the tank bottom was disturbed. (See NFPA QUARTERLY Reprint Q52-5, 40 cents or the October 1958 QUARTERLY, page 85.)

July 2. Charleston, S. C., South Carolina Electric and Gas Co. $360,000

PIPELINE, EARTH-MOVING EQUIPMENT, POWER TRANSMISSION LINE. About 11 A.M. a twin engine earth-moving machine struck and broke a buried 12-inch, 365 psi, gas transmission line. The escaping gas ignited immediately, severely burning the operator of the machine before he could escape. Attempts were made to save the equipment by pushing it out of the way, but these attempts failed.

The utilities of this company were grouped in the same easement. Therefore the leaping flames exposed 110 kv and 44 kv electrical transmission lines. The heat of the gas-fed fire was great enough to warp the supporting poles for the electrical lines, breaking them and snapping the lines. This left the entire city of Charleston, S. C., without power for over 15 minutes and parts of the city were out for up to three hours.

The gas line was never entirely shut down. The transmission pressure was throttled down to 75 psi and a bypass was constructed around the break; then the main line was repaired and returned to service. The gas fire burned until the bypass was constructed and the gas shut off, a total of 36 hours.

July 22. Center Twp., O., American Electric Power Co., Inc. $250,000

TRANSFORMER. Eight months after a new 260,000 kva transformer had been placed in operation an electrical disturbance caused part of its approximately 10,000 gallons of oil to spurt from pressure relief vents and from around side-mounted low voltage bushings. The intense fire that broke out was extinguished by employees using foam lines but not before equipment outside the transformer had been extensively damaged. Most of this

Charleston AFB Fire Department

A 12-inch gas transmission line was broken when struck by an earth-moving machine at Charleston, S. C. The fire went out after a by-pass was constructed around the break. See report on preceding page.

damage could have been prevented had the automatic water spray system for the transformer been completed and in operation. Though piping had been completed two months before the fire, installation of the tripping device had not been completed.

Forest Fires

There were 9 forest fires in 1958 which caused a loss of over $250,000. Five were in the United States — Alaska (1); California (4); while 4 were in Canada — Alberta (1), British Columbia (3). These fires caused an estimated total of $7,781,500 loss. Cost of suppression is not included in this figure. For the five fires for which this cost was available, it totaled $1,730,500.

Aug. 2, northwestern Alberta $2,165,500

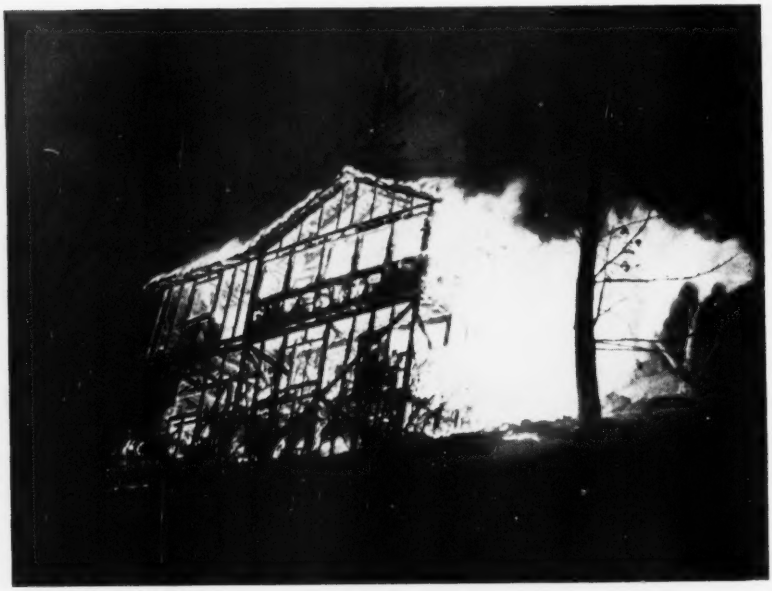
The largest forest fire occurred in northwestern Alberta. Caused by lightning (as were all reported large loss Canadian forest fires), the fire destroyed over 150,000 acres for a loss total of $2,165,500.

There had been no rain in this area since spring. The myriad of forest fires in progress in British Columbia caused so much smoke that it obscured visibility. This fire was able to burn for some time before it was spotted through the smoke by the lookouts.

The area of origin was 40 miles from the nearest road. Fire fighters with hand tools were flown in by helicopter. Bulldozers started in toward the fire in pairs, thus if one got stuck the other could pull it out. It took seven days for the first team of bulldozers to make it to the fire. High winds hampered the control efforts. The fire was confined, but control of all ground fire was not made for six months. By the end of January the last vestige of fire in the 150,000 burned acres was out.

Oct. 3, Monrovia, Calif. $2,000,000

Children playing with matches caused this fire which destroyed 12,795 acres of watershed and 40 summer cabins. Fortunately there was no loss of life. The suppression cost ran up to $500,000.



Los Angeles County Fire Department

Twenty-nine dwellings were destroyed in the Malibu Beach, Calif., fire. See report on this page.

Dec. 2, Malibu Beach, Calif. $300,000

A fire of suspicious origin was reported about 10:30 A.M. At approximately 11:15 A.M. another fire of similar origin was reported in the same area. These two fires joined at 12:30 P.M. becoming the "Liberty Fire." This area had had less than .60 of an inch of rain since July 1.

During the dry spell there were Santa Ana winds. These winds are caused by high barometric pressure in the desert areas driving hot dry air, at up to 100 miles per hour, through the mountain passes to a low pressure area at sea. The dry conditions, combined with the "Devil Wind," accounted for the fire's six mile spread in the next seven hours. Before the fire was out 18,060 acres were burned, 29 dwellings and 2 fire department pumpers destroyed.

The equipment used to fight the three-day fire included 74 engine companies, 27 patrols, 10 bulldozers, 5 aircraft and 8 helicopters and over 1,800 men.

Dec. 17, Cleveland National Forest, Calif. $952,500; 1 killed

A 21-year-old man fired a tracer bullet into dried grass. Before the fire was put out a U. S. forest ranger was killed, 66,300 acres were burned over, 19 buildings destroyed.

Cost of suppression is estimated at $645,300. Suppression operations included a force of 76 pumpers, 51 bulldozers, 12 aircraft, 4 helicopters and over 2,500 men.

Transportation Fires

There were 55 large loss fires involving transportation vehicles. Aircraft fires accounted for 50 large losses, railroad rolling stock for 3 and ship collisions for 2.

Ships

The large ship losses of 1958 were limited to two collisions involving tankers. Twenty persons were killed and 61 were injured in these accidents.

June 25, East River, N. Y., Empress Bay and MS Nebraska $662,000; 2 killed

Just after midnight on the morning of June 25, a tanker and a freighter approached each other in the East River of New York

United Press

Eighteen crewmen died following collision of an empty with a loaded tanker in the harbor of Newport, R. I. Photo shows the S. E. Graham. See report on this page.

City. The 5,000 gross ton freighter Nebraska was heading down river from Long Island Sound. The 531 gross ton tanker Empress Bay was heading up river loaded with 6,500 barrels of automotive gasoline. Through a misunderstanding in passing signals, the ships collided and the Empress Bay burst into flames. Skillful maneuvering by the pilot of the Nebraska which caught fire, too, kept the ships off the piers. The fireboat William J. Gaynor was gashed in the hull by the Nebraska's propeller on its second rescue pass. The fireboat was kept afloat by lashing to a pier and by fire pumpers, until emergency repairs were completed. The Gaynor had saved 25 persons on the two passes.

Aug. 7, Newport Harbor, R. I., S. S. Gulfoil and S. E. Graham $1,300,000; 18 killed

About 6:45 A.M. the morning of August 7, two tankers collided in the entrance to Newport Harbor, R. I. The 501-foot S.S. Gulfoil was outbound in ballast after discharging her cargo of 40,000 barrels of gasoline and 30,000 barrels of fuel oil. The S.E. Graham was inbound with 21,850 barrels of gasoline. In a dense fog the ships collided and immediately burst into flames. Ten minutes later the Gulfoil was racked by explosions. All 18 fatalities occurred on the Gulfoil.

Fire fighting tugs controlled the fire on the Gulfoil and stood by the Graham as it burned for 36 hours before its cargo was consumed in fire.

Helicopters were used in supplying foam materials to the tugs.

Railroad Rolling Stock

The 1958 railroad rolling stock large losses were mainly the result of three explosions. Two of the explosions occurred during switching operations of a tank car loaded with nitromethane. Both of these explosions left similar sized craters in the earth. Had these explosions occurred in an area of dense population the loss figure and fatal injuries could have been tremendous.

The other explosion occurred in tank cars that had been overturned during a derailment.

Woodfin Camp

Derailment of 31 cars of a freight train at Shattuck, Okla., was followed by fire and explosions in the wreckage. See report on this page.

Jan. 22, Niagara Falls, N. Y., Niagara Junction Railroad $1,000,000

Approximately 200 people were injured, buildings within a ½-mile radius were damaged and windows within a 3½-mile radius broken by the detonation of a tank car in the marshalling yard of the Niagara Junction Railroad. A hole was found in the marshalling yards approximately 50 feet wide by 85 feet long and 16½ feet deep. The tank car contained 77,280 pounds of nitromethane and was latched on one end of a string of cars being made up into a train. Just prior to the explosion a switch engine had started three cars "drifting" in the direction of the nitromethane car. It is surmised that the rolling cars struck the nitromethane car and that the shock detonated the contents. It is possible that contaminants had caused the contents to become shock sensitive.

March 4, Shattuck, Okla., Santa Fe Railroad, et al. $500,000

While a 142-car freight train was moving through Shattuck, a drawbar broke and caused this early morning derailment of 31 cars, including 22 cars of various petroleum products. An intense fire involving flammable liquids and LP-Gas released from ruptured tank cars broke out in the wreckage. Fifteen minutes after the wreck occurred the first of six explosions occurred in the tank cars. Some of the tanks were hurled several hundred feet, one flying 1,100 feet. Glass was broken and walls cracked within 10 blocks of the accident. Miraculously no one in the nearby dwellings was injured seriously by this predawn accident.

June 1, Mount Pulaski, Ill., Illinois Central Railroad $1,000,000; 2 killed

The January 22 explosion raised a great debate as to whether or not nitromethane should be shipped in tank cars. The question was still "under discussion" when 2 men were killed and approximately 40 persons injured in the detonation of a tank car of nitromethane in Mount Pulaski, Ill. A crater 35 feet deep and 50 feet in diameter was blasted in the earth.

The tank car exploded while standing with other cars on a siding three-quarters of a mile from the center of town until local cars could be assembled and added to the train. At the time of the explosion a string of local cars was being backed to the siding, but there was reportedly still a considerable distance between the moving and standing cars when the explosion occurred.

On the day following the explosion, the ICC banned all tank car and tank truck shipments of the entire nitroparaffin family. Later the ban was removed except for tank shipments of nitromethane.

Aircraft Fires

Losses from the 50 large loss aircraft fires of 1958 included 195 people killed and $129,550,000* damage. One hundred and eighty-six of the fatal injuries occurred to persons aboard the aircraft, while the 9 remaining occurred to those on the ground. The average loss per accident was approximately 4 persons killed and $2,591,000 damage. These figures show slight increases in both the fatality average and the loss per accident over the 1957 figures but the number of such accidents decreased by 12. Thirty-two of the large aircraft fires were due to crash fires, 9 occurred on the ground, 5 were the result of explosions-in-flight, and 4 resulted from in-flight fires which could not be controlled. Military aircraft were involved in 42 cases, commercial transports in 8.

Crash Fire Incidents

Thirty-two of the large loss aircraft fires of 1958 were crash fires where survival was judged possible had fire not occurred. Eliminated from this list are incidents involving high valued aircraft which crashed and burned following severe (power-on) impacts with the ground, such as the Capital Airlines Viscount accident at Midland, Michigan on April 6, costing 47 lives. Also omitted are in-flight collisions between aircraft even if fire did result. In 1958, there were a number of serious accidents of this type, one costing 49 lives when a United Air Lines DC-7 and an Air Force F-100F collided in clear sunny skies near Las Vegas, Nevada on April 21. Eight of these 32 incidents are briefly reviewed here.

Jan. 9, Bohemia, New York, Eastern Air Lines Constellation Super C. $750,000

When crash crews reached the scene of this accident, the left inboard engine of the Constellation was on fire, one occupant was trapped in the cockpit, a gasoline spill had occurred due to the severance of the fuel tank by the crash impact and a small flash fire had occurred in the cockpit.

Fortunately, this accident happened during a routine pilot training flight so that there were only four crew members aboard the Constellation when the landing gear struck a snowbank on the approach end of the runway. After hitting the snowbank, the plane slid approximately 800 feet in a tail first position down and across the runway before coming to stop in approximately a foot of snow. The left landing gear, the forward landing gear, two engines and the left wing were partially torn loose and the left inboard engine was on fire.

The MacArthur Airport, where the accident occurred, is provided with rescue equipment by the Sperry Gyroscope Company. Available are a modified Class 155 foam truck, a Type 0-1 low pressure carbon dioxide unit, and two dry chemical jeeps.

One of the jeeps was the first to arrive at the scene with three crash crew members aboard. They made immediate entry into the fuselage and using crash rescue tools, a pinch bar, bolt cutters and crash axes, they were able to remove the flight engineer who was trapped in the cockpit by the crushing of the forward landing gear which protruded up into the cockpit. This man suffered multiple lacerations of the face and forehead as well as having his hair singed by the flash fire that occurred in the cockpit, almost instantaneous with the impact. The crash rescue crewmen also de-energized all electric power and placed the fuel flow switches in an "off" position. The three other occupants of the fuselage were in a state of shock and were assisted out by the crash crewmen.

Approach by crash trucks was hampered by a 4-foot snowbank, but the carbon dioxide and foam trucks managed to get close enough to stretch hand lines to reach the left inboard engine. This was done while the rescues were being accomplished.

The attack on this engine fire was completely successful, but the application of fire extinguishing agents was continued to blanket the engine and fuel spill and to coat the fuselage with an insulating blanket of foam. It was not necessary to use the dry chemical units although they were placed in standby positions with their lines charged.

*Since it is not possible to separate fire damage from impact damage, loss figures include both.

The combined use of carbon dioxide and foam worked out very well. Approximately 1,000 pounds of carbon dioxide was used through a 150-foot hand line dispensing 750 pounds per minute. This application extinguished the engine fire within seconds. One 300-foot, 1½-inch hand line was used from the Class 155 truck and another similar sized line was used from the carbon dioxide unit. It is estimated that approximately 1,300 gallons of foam were dispensed through these lines. Total extinguishment was secured within 10 minutes of the accident and the rescues accomplished within 5 minutes.

Feb. 11, Ellsworth Air Force Base, South Dakota, U. S. Air Force B-52. $10,017,000; 5 killed

This largest fire loss of the year dollar-wise illustrates tragically how severe is the crash fire potential of large multi-engine aircraft. Despite arrival of eleven major pieces of fire apparatus manned by 71 fire fighters within seconds of the aircraft coming to rest, it took almost an hour to even bring the fire under control. Among the worse complicating factors were:

1. The aircraft caught fire immediately upon coming to rest;

2. Several severe explosions occurred in the main JP-4 fuel tanks just after fire equipment arrived, forcing fire fighters to reposition equipment;

3. Two of the eight jet engines continued to operate for 20 minutes hampering close fire fighting approach;

4. About 50,000 pounds (over 7,000 gallons) of JP-4 fuel ignited and the tank explosions completely enveloped the aircraft in flames; and

5. The temperature was 6 above zero with fog and light snow falling and a 7 mph wind.

The B-52 was making an emergency landing with three engines dead (caused by icing of fuel lines in flight). Emergency fire crews were alerted at 1456. The aircraft made a wheels down landing ¾ths of a mile from the runway threshold. The left wing of the giant plane struck an ILAS building, a power line pole and then the plane travelled down and up a 6- to 8-foot-deep railroad cut. These impacts sheared off the left wing. The aircraft then skidded across a banked roadway, which broke off the main gear, slammed through a cyclone fence, which broke the aircraft about midships, and finally came to rest on the airfield.

Fire crews arrived within a minute and initially positioned equipment near the nose of the aircraft to attempt rescue of trapped crewmen. Six crewmen were able to evacuate and were observed running from the scene by arriving firemen. Two were known trapped within the burning forward cabin. The combined agent technique of using foam and low pressure carbon dioxide to achieve control in the rescue area was attempted but this attack had to be against the wind initially to cover the forward cabin. The explosions and severe heat and smoke forced fire fighters to shift positions to the windward side. The Type 0-6 USAF crash truck was damaged before it could be moved. It was quickly obvious that the two trapped men could not be saved.

Subsequent fire fighting was primarily with foam. Four Type 0-11A's and two Type 0-10's were employed with one 1,000-gallon tanker and 2 pumpers relaying water to these units. The pumpers delivered water through one 1500-ft. and one 1750-ft. 2½-inch hose lines permitting uninterrupted foam fire fighting on the main wreckage area. The left wing and tank were located about 1500 feet away from the balance of the burning wreckage. Total extinguishing media used: 4,000 lbs. of carbon dioxide, 3,300 gals. of foam liquid, 640 lbs. of chlorobromomethane and 56,800 gals. of water.

The two crew members who were not able to escape unassisted died in the fire and three men inspecting the equipment in the ILAS building were killed from impact injuries. The aircraft damage was $8,000,000. The left wing of the B-52 and the ILAS building (valued at $2,017,000 — including contents) burned separately 1,500 ft. from where the main aircraft wreckage came to rest.

Feb. 13, Palm Springs, Calif., Western Air Lines Convair 240. $500,000

The Civil Aeronautics Board has reported that the probable cause of this accident was the failure of a mechanic to secure properly the right wing leading edge section. As a result of inadequate inspection procedures, this maintenance defect was not detected until the aircraft was in flight.

Severe control difficulty in flight resulted in an attempted emergency "gear-down" landing in the desert four miles from the Palm Springs Airport. During the ground roll, the aircraft struck large boulders in its

Wide World

All 21 occupants escaped unassisted from this burned Convair which crashed after an emergency landing near Palm Springs, Calif. on Feb. 13.

path and fire occurred which consumed a large portion of the two engine airliner. There were no fatalities, but serious injuries resulted to five of the 18 passengers and minor injuries to most of the others. The crew of three received minor injuries.

From the fire point of view, this accident illustrated again the advantage of segregated fuel cells in this particular aircraft. The fire began outboard of the left nacelle and while the aircraft was eventually completely consumed, all 21 people were able to evacuate before the fire entered the fuselage.

The evacuation was accomplished through exits on the right side of the aircraft. The front loading door was opened by the pilot and the first and second window exits were opened by passengers. A third passenger, with the stewardess, attempted to open the rear emergency door, but found it jammed. The evacuation, through the three available openings, was done in an orderly and rapid manner and seat belts are given credit for reducing the danger of injury prior to the evacuation.

Although all passengers moved a respectful distance away from the burning plane, no explosion occurred. No fire fighting was accomplished since the area of the impact was inaccessible and by the time rescue crews reached the scene, the aircraft had been almost totally consumed.

March 17, Melbourne, Florida, Eastern Air Lines 404. $750,000

In a report of this fire issued in a bulletin distributed by the Air Line Pilots Association, the statement is made that "because of inadequate fire fighting equipment at the airport, the aircraft was a total loss. Equipment was dispatched from an Air Force Base 30 minutes away. It was the opinion of almost everybody on the scene that had adequate fire fighting equipment been available, the aircraft would have been saved."

The Eastern Air Lines plane struck a three-foot pile of gravel at the end of the runway while coming in for a landing. The runway is only 4,000 feet long and requires short field technique including an early touchdown. After the landing gear struck the gravel pile, the drag strut attachment tore loose from the front spar. This apparently resulted in the rupture of a fuel line at the spar which permitted the spillage of fuel and the resultant fire.

Aboard at the time were 7 passengers and 3 crew members. The stewardess was able to shepherd the seven passengers to safety before the flames reached the fuselage. The initial fire originated near the left engine and was slow to develop as a major threat since the fuel spillage was originally just from broken lines and not from a ruptured tank.

The Melbourne Fire Department was called, as well as Air Force equipment from the Patrick Air Force Base. The Melbourne Fire Department reached the scene in 7 to 8 minutes, but could not do anything with the fire which by this time had gained considerably in magnitude. The Air Base equipment had to travel 18 miles to reach the scene and once they were there they were able to extinguish the fire in 3 to 4 minutes. Of course, by this time, most of the fuel had been consumed and there was little left to constitute a major extinguishment problem.

May 2, Newark Airport, New Jersey Eastern Airlines DC-7B. $500,000

An over-run of the runway by about 150 feet caused the main gear of this Eastern Airlines DC-7B to fail in the soft ground. The two left tires and the right inboard tire blew out during the landing roll and the aircraft came to rest on the left wing and right gear after turning about 45 degrees.

The alarm was given immediately by the control tower and the airport crash units responded and upon arrival found the No. 2 engine on fire. Ten of the 47 aboard the plane had escaped unassisted by the time the emergency crew reached the scene. The balance were helped from the aircraft by some of the fire fighters while others concentrated on attacking the engine fire with fog foam and dry chemical. This attack was very successful with extinguishment completed within one minute.

The fog foam was used to knock down the fire and to achieve cooling of the heated metal surfaces and the exhaust manifold. The dry chemical was effective in knocking

Newark News

out the hidden fires within the engine itself. By the prompt response of fire apparatus and the effective utilization of the equipment available, the aircraft loss was held to a minimum.

June 27, near Westover Air Force Base, Mass. USAF KC-135A. $5,000,000; 15 killed

One of the worst tragedies of the year occurred when this KC-135A jet tanker crashed shortly after take-off, killing all 7 crew members and the 8 passengers aboard. The aircraft, the third of four KC-135A's, scheduled for a transatlantic nonstop flight to London and return, carried 6 newsmen and 2 observers from the National Aeronautics Association. This was all part of a special mission aimed to demonstrate the capabilities of the Strategic Air Command with these new tanker planes which are of the same *basic* design as the Boeing 707 commercial transports.

A USAF Accident Investigation Report has been issued blaming the "complications in aircraft handling technique compounded by flight instrument limitations" as being the cause of the tragedy. The accident occurred seconds after take-off and approximately 4,000 feet from the end of the run-

Sterling's

The Melbourne, Fla. Airport did not have adequate crash fire protection on March 17 when this Eastern Airlines 404 crashed while landing.

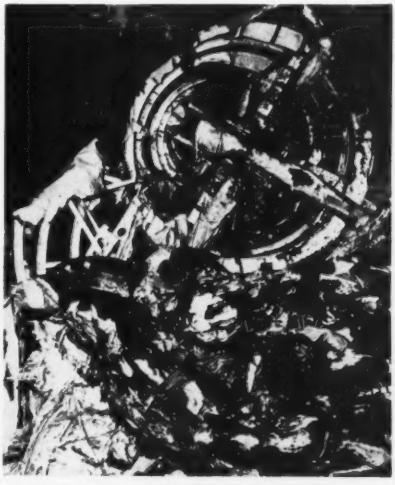
way. At that point, the aircraft's fuselage, left wing and engines struck tree tops that were approximately 16 feet above the runway elevation. After an additional 700 feet, the aircraft again struck tree tops and then hit 6 commercial power cables and then the ground.

The aircraft was completely destroyed by ground fire which was so intense that no rescue opportunities were presented. The first fire equipment to reach the scene was a unit operated by the Massachusetts Turnpike Authority which responded since the crash sprayed burning gasoline over a section of that highway.

Aug. 15, Nantucket Airport, Mass. Northeast Airlines Convair. $500,000; 24 killed

The loss of visual reference while attempting a visual approach is believed responsible for this worst U. S. aircraft crash fire accident of 1958 which claimed the lives of 24 persons. Miraculously ten other passengers escaped, although all were injured and most suffered severe burns.

It is particularly ironical that this should happen with a Convair aircraft since it is the first time in NFPA records that a fire death has been recorded in a crash involving this particular plane. There has been one other fatal Convair accident involving fire but this occurred from an in-flight fire (see NFPA Aviation Bulletin No. 142, page 18).



Wide World

All details of this Nantucket crash are not yet available so that a full explanation of what occurred is not possible. The medical examiner, however, notified the Associated Press that burns were responsible for the deaths of 18 of the 23 persons killed outright (the 24th person died some days later in the Massachusetts General Hospital from a combination of severe body burns, fractures and internal injuries). He is further quoted as having said that "there is little doubt that many of the dead would be alive had the plane not burst into flames."

It would appear from the evidence available and the photographs that when the ship struck short of the runway, a rather severe disintegration occurred which resulted in fuel from the shattered wings being thrown in a mist cloud into the main wreckage area.

The landing had been attempted after dark with fog patches restricting horizontal visibility to as low as 1/8th of a mile. It is presumed that the pilot was able to see the runway lights through the thin patchy fog for a considerable portion of his final approach, but when this visibility was lost, the pilot was unable to take over on instruments and check his descent before hitting the ground short of the runway.

It has been noted in the Massachusetts Aeronautics Commission Report that the Nantucket Airport does not have approach lights or instrument landing facilities. They also feel that an effective approach lighting system might well have prevented this particular accident and the State Legislature has been requested to appropriate money for these lights where they are needed and where the Federal Government will not supply them.

Nov. 19, El Toro Marine Corps Air Station, California, U. S. Marine Corps. F4D-1. $500,000

It is rather ordinary to hear of a collision between a railroad train and an automobile, but when a train hits an aircraft, needless to say, it is quite an unusual event. This occurred in this incident.

The pilot of an F4D-1 "Skyray" noted a rough engine while in flight and made a precautionary flameout landing at the El Toro Air Station. The aircraft landed fast, went off the end of the runway and ended up on a railroad track after crashing through a fence and power line.

When the aircraft came to rest, the pilot unstrapped himself and started to get out of the plane, apparently not observing an oncoming train which struck the aircraft and threw the pilot 30 feet into a plowed field. His only serious injury was a broken arm!

The engine and several cars of the train were derailed by the collision. Crash equipment moved to the crash scene through the hole in the fence made by the aircraft and other crash equipment went through an adjacent gate approximately 400 yards to the south; thus, crash equipment was available on both sides of the railroad line.

The F4D-1 was enveloped in flames, but this was extinguished by one MB-1 and one MB-5 truck. Another MB-5 and a Type 0-6 extinguished other small fires on the airfield side of the train within approximately two minutes. No major fire damage was caused to the railroad's rolling stock. The pilot was rushed by a rescue helicopter to the Base Hospital in a well-integrated rescue.

It is interesting to note that in this case the aircraft landed 300 feet in front of an arresting gear across the runway, but bounced 20 feet over the gear cables negating the effectiveness of this runway overrun equipment.

Fires and Explosions in Flight

Nine of the large aircraft losses during 1958 resulted from fires in flight (4) or explosions while aloft (5). Three of these are reported in this Summary, 2 involving military aircraft and one a commercial transport. The B-47 was involved in 4 airborne explosions and 1 in-flight fire; no details are available to the NFPA on these accidents. In 1957 there were five airborne explosions involving military aircraft. On August 14, 1958 a Royal Dutch Airlines Super Constellation crashed into the Atlantic off the Irish Coast with the loss of all 99 persons aboard. There was some evidence to suggest an explosion in flight, but the full facts have not been established to date and may never be known because of lack of positive evidence. The bodies of 35 recovered showed evidence of an in-flight blast and fire.

March 22, near McClellan Air Force Base, California, USAF RC-121. $2,018,000

The airfield's crash crews had been alerted by the control tower to stand by for an on-base emergency landing of an RC-121, and the equipment was in the process of assuming their crash positions when the four engine "flying radar" plane crashed approximately 8 miles north of the Base in a wet and soggy, cultivated grain field.

The cause of the accident was an in-flight fire in the No. 2 engine during the take-off climb. Because of the loss of power, the aircraft had been unable to maintain sufficient altitude to return to the Base. All 18 crewmen escaped unassisted with injured members of the crew being assisted in evacuating the burning plane by others with less serious injuries.

The off-base crash assignment of two type 0-11A's, one brush truck and one water tanker was dispatched to the scene. While enroute, a radio call was made to the Base to dispatch the rescue Weasel because of the soft ground which prevented the other vehicles from reaching the crash site. Responding personnel had to abandon their trucks and walk ½ mile through the soggy terrain to the crash scene. By the time the rescue Weasel arrived, it was too late to aid in the evacuation of the air crew, but the vehicle was used to transport investigators subsequently to the wreckage. No fire fighting could be conducted.

March 25, near Miami International Airport, Braniff Air Lines DC-7C. $1,500,000; 9 killed

When this DC-7C took off shortly after midnight from the Miami International Airport with 24 persons aboard, fire was observed by both those on the ground and in the aircraft in the No. 3 engine. Tower personnel noted that when the plane was about 900 feet off the ground, a bright orange glow existed around the right side of the aircraft. The plane was then observed to enter a descent, and immediately prior to the impact the tower heard an aborted radio call which gave only the flight number. No other message was received.

The Civil Aeronautics Board's investigation noted that the fire was confined within the No. 1 zone of the No. 3 engine up until the time of the impact. It is their conclusion that the captain of the aircraft failed to maintain the necessary altitude during an emergency return to the airport because of

Wide World

This "flying radar" plane crashed 8 miles from McClellan Air Force Base on March 22. Crash fire fighting vehicles could not go across the cultivated grain field to reach the burning plane.

his "pre-occupation with the engine fire." The CAB report also indicates that the second officer had pulled back the No. 3 throttle and feathered the No. 3 engine upon instructions of the pilot. The co-pilot actuated the firewall shutoff for the fuel system to this engine and discharged the installed fire extinguishing system for the No. 3 engine. Within seconds thereafter, the airplane had crashed with the right wing tip contacting the ground first.

The aircraft broke up as it came to rest in an open marsh. The fuselage was in three major sections and the occupants who were ambulatory were able to evacuate without difficulty. The scene was lighted by the severe ground fire. Four Braniff crew members deadheading to Panama and five other passengers died. The captain and first officer were seriously injured and the other flight personnel sustained relatively minor injuries.

The control tower notified the airport fire department of the crash and equipment responded but could not reach the actual fire scene due to the terrain conditions. The road distance was almost six miles and the fire equipment was delayed by a heavy ground fog. Coast Guard helicopters were dispatched and arrived at the scene approximately 35 minutes later. They were used to air lift injured occupants of the plane to Miami hospitals. For all practical purposes, there was no fire fighting due to the inaccessible location of the wreckage.

The in-flight fire is blamed on the failure of the No. 11 cylinder of the No. 3 engine. The cylinder wall contained evidence of scuffing and the connecting rod had failed, pinpointing this as the source of the malfunction.

June 13, McChord Air Force Base, Washington, U. S. Air Force TF-102A. $1,400,000

"Fitz, you're on fire!"

In this way, Lt. Thomas Fitzgerald learned that his TF-102A was on fire as he was attempting a take-off. At almost the same moment, the fire warning light blinked on his control panel. At the time the aircraft had just taken off and it was about 150 feet in the air moving at a speed of approximately 190 miles an hour. He nosed the ship down after actuating the landing gear. The aircraft struck the runway about 680 feet from a crash barrier on the 10,100 foot long strip. The speed of the aircraft, however, was so great that it ran through the crash barrier, ripping off the landing gear, then sliding through a perimeter fence and across a highway into an open field that was largely dirt and lightly grassed. The pilot obviously did not have time to actuate his drag chute.

After the plane came to rest, the two pilots escaped unaided with only minor flash burns. Fire equipment responded immediately as the crash crew saw the accident and the alarm was given by radio and emergency phone. On arrival at the scene, straight stream foam was used from the turrets of

three Type 0-11A's and one Type 0-10 crash units. The trucks then moved in and used the spray pattern foam along with low pressure carbon dioxide from a Type 0-6 crash truck to suppress and control the fire.

A 750 gpm pumper laid 3½-inch hose from the nearest hydrant (1,600 feet away) preparatory to furnishing water to the crash trucks. Actually, however, the fire control and extinguishment was secured so quickly that this extra supply of water was not needed. The crash trucks were replenished, however, from a 1,000-gallon tanker which also responded to the call. The fire fighting attack consumed 800 lbs. of carbon dioxide and 365 gallons of foam concentrate.

Ground Fire Incidents

Nine aircraft burned on the ground or while on the movement area of an airport during 1958 which involved a loss in excess of $250,000. Four of these are analyzed in this review of aircraft fire losses, three involving military aircraft, one commercial. The commercial accident occurred during an attempted takeoff, which might be classed as a crash fire except that it did not initially involve significant ground impact damage and resulted in only minor derangement of aircraft structural components.

Jan. 27, Quonset Point Naval Air Station, Rhode Island, 2 U. S. Navy HSS-1's and 1 — HUL. $850,000; 1 killed

A blood clot on the brain of the pilot of an HUL helicopter was the cause of this peculiar flight line accident at the Quonset Naval Air Station. Due to the physical handicap, the pilot inadvertently lifted the aircraft while the portable electric generator was attached. In so doing, the starboard skid of the helicopter engaged the generator and the aircraft upset.

The rotor blades were shattered on the cement apron and pieces of the blade ruptured the fuel cell on a nearby HSS-1 helicopter and most probably also on the HUL. The gasoline which was spilled was apparently ignited by torching at the exhaust of the operating helicopter and the whole area was immediately engulfed in a large uncontrollable fire.

Another nearby HSS-1 was also damaged by the propeller missiles and could not be removed before extreme heat caused its almost total destruction. The body of the pilot could not be reached until the fire was brought under control.

The fire station was only approximately 4,000 feet from the scene of the accident and response was prompt with five crash trucks and 19 fire fighters. Flames were about 300 feet in the air when the first units arrived. The fire fighting attack was with low pressure carbon dioxide and foam. Figures given on the amount of agent used indicate that some 6,000 pounds of carbon dioxide and 55,800 gallons of made-foam were dispensed from the crash units.

Magnesium complicated seriously the extinguishment efforts and it was approximately one hour and a half before the fire was judged under control. A training program has been set up at the Base to utilize grapple equipment to isolate burning magnesium as an integral part of the fire suppression activity on helicopters which do have a large percentage of magnesium components.

March 1, New Haven, Conn., American Airlines Convair 240. $250,000

While on a scheduled flight from Boston to New York, this Convair made a scheduled stop at New Haven. The aircraft was not refueled during the 5 minute lay-over and the flight departed with 5 passengers, 3 crewmen and 460 gallons of fuel. As the aircraft proceeded down the runway for take-off, the landing gear was retracted unintentionally before the aircraft reached the required flight speed. This was made possible by malfunctioning of the left gear safety switch and the Civil Aeronautics Board indicates that a contributing factor was inadequate inspection by maintenance personnel.

When the aircraft came down on the runway, a fire broke out in the left engine. A propeller fragment penetrated the lower wing surface and punctured the fuel tank. After the plane came to rest, the 8 occupants escaped through an emergency exit over the right wing and the right main door.

The airport is protected by the city fire department which has an engine house located on a city street immediately adjacent to the airport. An automatic emergency access gate across from the fire house gives prompt entry on to the airfield.

Wide World

A small crash unit extinguished this Convair fire at New Haven, Conn. on March 1 after propeller fragments punctured a wing fuel tank.

The fire alarm headquarters received a call advising of the emergency and the fire equipment was ordered to respond at 10:26 A.M. The first unit was a pumper and a small crash wagon carrying 200 gallons of water, 20 gallons of foam concentrate, a foam turret and two fog foam hand lines. The pumper fed a continuing water supply to the 2½-inch intake of the crash unit dropping off a 2½-inch feeder line at a street hydrant 1,100 feet from the crash site. This pre-planned operation allowed the small crash unit to maintain a continuous foam attack on the burning fuel until extinguishment was secured.

In addition to the 20 gallons of foam concentrate on the unit, fire fighters used 12 other 5-gallon cans of foam liquid. Most of this was required to check the flames as gasoline continued to flow from the ruptured wing, and to isolate the fuselage from the fire.

Again, it was demonstrated that on the Convair aircraft the isolation of the fuel containing sections of the wing from the fuselage was an important factor in permitting rapid control of this fire. With only 8 persons aboard this 40 passenger aircraft, and the fact that the accident occurred during daylight hours under generally favorable weather conditions, the incident was terminated without any loss of life and a considerable amount of salvage of the aircraft was possible.

March 7, Truax Field, Madison, Wisconsin, USAF F-102A. $1,200,000

A crash rescue vehicle was in standby position prior to the starting of this F-102A on the flight line at the Truax Air Force Base. Disintegration of the starter resulted in a fire from the shattering of the fuel lines by the hot metal. The fire immediately also involved a compressor and generator in close proximity to the aircraft.

It would have been thought that with the crash unit on standby, immediate application of extinguishing media would have been possible. The crash crewman, however, was handicapped by the fact that while he pulled the valves to charge the chlorobromomethane lines on the type R-2 rescue vehicle, the hand lines failed to charge. It was subsequently discovered that the valve controlling the nitrogen supply to the extinguishing media tanks had been turned off by persons unknown. It was, therefore, necessary to abandon this attempt to control the fire and to drive the rescue vehicle from the scene.

In the meantime, other crash trucks at the Base were alerted and responded, including a Type 0-10 and a Type 0-11A crash truck, backed up by a 1,000-gallon water tanker and a pumper. These units used foam hand lines in an attempt to cool and smother the fire and had fair success. The tanker was used to reload the crash trucks with water

Official USAF Photo

Disintegration of a starter on an F-102A caused this ground fire at Truax Field, Madison, Wisc. on March 7.

and CB hand lines were used from both the 0-10 and the 0-11A on stubborn spot fires.

While control was accomplished fairly promptly, the aircraft was judged a total loss as was the supporting equipment in the area. The Base has taken action to seal the nitrogen control valves on an R-2 unit in an open position to prevent a recurrence of the difficulty experienced in the early phases of this fire.

Aug. 14, McConnell Air Force Base, Kansas U. S. Air Force B-47B. $637,000; 1 killed

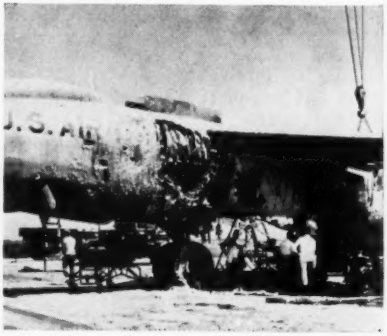
Workmen were in the process of dismantling this B-47B on the aircraft parking ramp, 36 feet from one of the flight line buildings. They were using an electric cutting torch in the bombay section of the aircraft and subsequent investigations disclosed that neither the fuel cells nor the fuel lines in the bombay had been removed nor had either the cells or the lines been purged of fuel. The electric cutting torch ignited fuel vapors, causing an explosion which killed one civilian workman, burned five others and caused physical injuries to two additional airmen.

The alarm was received by the fire department promptly after the explosion. Multiple units of crash fire fighting equipment were available and fire fighters used water and foam from turrets and hand lines to cool, smother and extinguish the fire. This was done rapidly and the fire was under control within 8 minutes.

The fuel vapors which ignited were thought to have originated from the aft fuel cells in the bombay section. The fire extended from this area to the forward landing gear, involving hydraulic oil and equipment in that area as well as in the intervening portions of the fuselage. The fire also extended to four maintenance stands and two rear dual tires of a nearby crane.

The Class A materials that were involved required cooling with water streams while the flammable liquid fires were handled by the foam. By virtue of the prompt fire fighting attack, an adjacent parked B-47 was not damaged.

As a result of this accident, recommendations have been made to remove all fuel cells and lines prior to conducting dismantling of condemned salvaged aircraft at this major maintenance base of the USAF.



Wide World

Results of improper use of cutting torch.

Large Loss Fires of 1958 — Conclusion

The only requirement for a large loss fire is that it destroy $250,000 worth of property. This can happen in a closet full of expensive radar equipment, in an aircraft fuselage, in several buildings, or in hundreds of acres of timber. The limitation of the value subject to a single fire then is the key to the elimination of large loss fires. If values of $250,000 are worth protecting, then the protection must be provided by someone; the responsibility is someone's.

Responsibility For Large Loss Fires

The *architect* has the responsibility to provide a safe structure. Undoubtedly he intends to have the building he designs or remodels standing for a long time. The calculations for foundation strength, earthquake protection and wind loading normally receive ample consideration, but all too often considerations of fire safety — value subdivisions, hazard cutoffs or private

Baker Fire Department

The report and picture of the Dec., 2, 1958 fire in Baker, Oregon that destroyed the original Levinger's Drug Store appears on page 273 of this QUARTERLY. The lessons of this large loss fire were understood by the owner of the store and the responsibility for the prevention of another similar fire accepted by him. The attractive new 75 ft. by 100 ft. building shown above was the result of this understanding and acceptance. The attic is subdivided into five areas and the building is 100 per cent sprinklered.

protection equipment — are overlooked with the result that a building otherwise strong and safe is destroyed by fire. This responsibility of the architect applies similarly to the design engineers concerned with air, sea and land transport vehicles. For instance, design weaknesses in aircraft have been shown to be major contributing factors in the crash fire hazard.

The *owner or occupant* has the responsibility to preserve his property. He must not only protect and maintain the heating, the plumbing and the exterior finish, but he must also maintain the integrity of the design features and the fire protection equipment provided to limit fire spread. Those who would never yank out a column, open up a foundation, or alter the ballast in a ship without careful thought as to the effect of their action on stability of the structure or the seaworthiness of the vessel will often, without any hesitation, puncture a fire wall, close a sprinkler valve, remove doors on stair wells, or allow their fire protection equipment to deteriorate.

The responsibility of the *watchmen and guards* should be emphasized. These men often are the only occupants of and are entirely responsible for a valuable building or other property. During working or operational periods, buildings, for instance, house workers with a payroll worth thousands of times the watchman's salary. During these periods management sees to it that the operations conducted in the building are under the supervision of qualified and highly paid persons, but at night an entire structure may be left in the hands of someone who has not had proper instructions, or proper training. It is during this period that many of the large loss fires occur.

Fire protection officials have even greater responsibilities. Fire chiefs, fire inspectors, fire protection engineers, fire equipment designers and salesmen, must all work together to explain the importance of proper building design and to show the value and adaptability of private fire protection equipment.

Educators — those teaching the engineering sciences, design, architecture, and fire protection — have the responsibility to see that each graduate is properly armed with the basic principles of fire protection, and that each man recognizes the power he commands over life and death through correct or incorrect design. A simple omission of a relatively inexpensive fire door can result in a severe loss, such as the death of 91 children and 3 teachers.

Insurance agents and brokers hold a similar responsibility to advise their clients on the importance of installing and maintaining a high level of fire safety in their properties, not only in the interest of preventing material losses but also life safety.

It is only through the recognition and acceptance of these responsibilities that proper fire protection will be provided. Once this problem of responsibility is resolved, then the lessons of large loss fire experience shown in this issue of the QUARTERLY can be fully implemented.

Table I

Factors Responsible for Large Loss Building Fires
1633 Fires During Period 1953-1958

NOTE: The figures in this table indicate the number of times each factor was noted as influencing fire spread or the extent of damage in the 1633 fires. In addition to the listed items many less frequently occurring factors were also reported. A combination of two or more factors was responsible for most of the large losses. The **boldface** type indicates the 1958 experience. The lightface type in the column headed total indicates experience during period 1953-1957 whereas in the remaining six columns the lightface type indicates total 1953-1958 experience.

	Principal Structural Defects Influencing Fire Spread							
	Total		Industrial	Mercantile	Storage	Residential	Educational	Misc.
FIRES ANALYZED 1953-1957	1347	...	483	243	246	72	72	231
FIRES ANALYZED 1958	....	**286**	**82**	**81**	**42**	**10**	**17**	**54**
Horizontal Spread								
FIRE DIVISION WALLS								
Too few in attics	129	**52**	18	71	11	18	30	33
Too few in basements	50	**19**	4	29	3	10	4	19
Too few in other stories	673	**143**	339	130	180	21	33	113
Substandard constructions	69	**9**	17	22	7	6	2	24
FIRE WALL OPENINGS								
No protection for opening	84	**14**	46	14	18	2	4	14
Fire doors blocked open or inoperative	19	**5**	8	2	4	...	3	7
Substandard protection for openings	13	**1**	9	2	1	...	1	1
COMBUSTIBLE INTERIOR FINISH								
Fiberboard	53	**21**	17	24	8	3	2	20
Other interior finish	36	**21**	15	18	3	4	4	13
Oil-soaked floors	33	**4**	16	1	2	...	5	13
Vertical Spread								
Stairwells not enclosed	366	**89**	118	121	68	43	32	73
Elevator shafts open	179	**27**	64	46	59	19	9	9
Nonfirestopped walls	134	**42**	7	53	9	19	23	65
Conveyor machinery openings not protected	63	**7**	50	3	16	...	...	1
Stairwell enclosure substandard	24	**15**	7	20	...	5	2	5
Pipe openings not enclosed	17	**6**	7	5	2	1	1	7
Elevator shaft enclosure substandard	14	**7**	7	7	2	3	...	2
Other openings, no or substandard protection	44	**11**	23	9	8	5	6	4
Spread to Exposures								
Congested combustible const., no exposure protection	291	**56**	138	42	54	19	3	91
Poorly constructed party walls	66	**17**	11	51	8	7	...	6
Interconnecting passageways, conveyors	49	**5**	27	8	11	5	...	3
Ordinary glass windows	40	**12**	7	20	6	8	2	9
Yard storage between bldg.	23	**7**	13	...	4	...	...	13
Other reasons for spread	40	**37**	27	22	4	4	1	19

Table I — Continued

Principal Contents Influencing Fire Spread

	Total		Industrial	Mercantile	Storage	Residential	Educational	Misc.
FIRES ANALYZED 1953-1957	1347	...	483	243	246	72	72	231
FIRES ANALYZED 1958	...	286	82	81	42	10	17	54
Flammable Liquids								
Escaped from tanks drums	184	27	119	28	31	3	5	25
Escaped from auto, aircraft tanks	38	11	7	3	8	...	...	31
In process equip. (1958 only)	...	9	8	1	...	...	...	...
Container explosion	13	9	8	3	5	...	...	6
Escaped from pipes	20	6	18	1	1	...	...	6
Other flammable liquid factors	63	25	46	8	12	1	1	20
Storage Methods								
Poor stock subdivision	184	30	54	45	99	2	...	14
Stock piled too high	63	15	13	11	36	...	...	18
Combustible wrappings	50	...	11	9	26	...	...	4
Inadequate window clearance	16	6	4	5	12	...	...	1
Other storage factors	73	23	13	17	36	2	3	25
Housekeeping								
Dust on structural members, etc.	109	22	97	6	17	...	4	7
Rubbish accumulations	55	13	22	17	14	3	1	11
Other housekeeping factors	33	20	33	8	4	2	1	5
Gases								
Natural gas	24	10	14	7	3	3	...	7
Acetylene	8	5	8	...	1	...	1	3
LP-Gas	6	6	3	6	1	...	...	2
Other gases	22	5	15	2	5	...	...	5

Principal Private Fire Protection Defects Influencing Fire Spread

	Total		Industrial	Mercantile	Storage	Residential	Educational	Misc.
FIRES ANALYZED 1953-1957	1347	...	483	243	246	72	72	231
FIRES ANALYZED 1958	...	286	82	81	42	10	17	54
Sprinkler Protection								
No sprinkler system	1135	239	391	311	245	56	86	285
Complete protection — unsatisfactory performance	100	14	82	...	22	3	...	7
Hazard too severe for system installed	23	1	21	...	2	...	...	1
Water supply poor or failed	20	1	16	...	3	2	...	...
Valves closed for miscellaneous reasons	18	4	10	...	5	...	...	7
Explosion damaged system	16	2	17	...	...	...	...	1
Valve closed too soon	8	2	8	...	2	...	...	...
Other reasons for unsatisfactory performance	15	4	8	...	9	1	...	1

Table I — Continued

	Total		Industrial	Mercantile	Storage	Residential	Educational	Misc.
Partial protection — unsatisfactory performance	23	**6**	15	4	5	3	1	1
Origin in unsprinklered areas, spread to sprinklered areas	21	**6**	14	4	4	3	1	1
Valve closed, defective	2	...	1	...	1	...	...	...
Fire Detection								
No watchman or automatic detection	781	**151**	208	244	156	60	74	190
Unsatisfactory watchman service	175	**32**	83	20	47	11	8	38
Failed to detect fire promptly	140	**13**	55	16	35	5	7	35
Patrolled outside building only	12	**6**	6	3	5	...	...	4
Protected area too large	11	**4**	6	1	1	...	4	3
Asleep	6	**2**	2	1	4	...	...	1
Other reasons for watchman failures	35	**13**	27	3	10	3	...	5
Unsatisfactory automatic detection	6	**2**	3	...	1	...	...	4
Fire Alarm Transmission								
Transmission delayed	249	**60**	110	53	47	21	13	65
Occupants fought fire	90	**24**	42	16	26	6	4	20
Telephone wires burned	29	**8**	10	8	2	6	2	9
Telephone inaccessible	16	**4**	10	4	2	1	...	3
Watchman fought fire	10	**1**	3	...	4	...	...	4
Other reasons for delayed transmission	104	**23**	45	25	13	8	7	29
Fire Brigades								
No fire brigade	163	**46**	111	10	34	10	8	36
Unsat. performance	60	**9**	33	1	13	...	3	19
Fire too advanced on discovery	18	**3**	11	1	8	...	...	1
Insufficient equipment	7	**2**	5	...	2	...	1	1
Other reasons for unsatisfactory performance	35	**4**	17	...	3	...	2	17
Portable Fire Extinguishers								
No fire extinguishers	5	**3**	2	1	4	...	...	1
Unsat. performance	184	**45**	102	22	36	13	7	49
Fire too advanced on discovery	136	**14**	68	11	20	10	6	35
Wrong type for class of fire	24	**11**	11	4	9	1	...	10
Other reasons for unsatisfactory performance	24	**20**	23	7	7	2	1	4
Standpipes and Hose Systems								
No system	113	**30**	57	17	27	4	3	35
Unsat. performance	72	**29**	55	2	13	4	8	19
Fire too advanced on discovery	50	**13**	34	1	8	2	6	12
Other reasons for unsatisfactory performance	22	**16**	21	1	5	2	2	7
Special Extinguishing Systems								
No system	57	**2**	33	2	3	...	...	21
Unsat. performance	8	...	7	1	...	...	...	...

Table I — Concluded

Principal Public Fire Department Handicaps Influencing Fire Spread

	Total		Industrial	Mercantile	Storage	Residential	Educational	Misc.
Fires Analyzed 1953-1957	1347	...	483	243	246	72	72	231
Fires Analyzed 1958	...	**286**	**82**	**81**	**42**	**10**	**17**	**54**
Water Supplies								
Inadequate	131	**56**	81	30	31	9	19	17
No public supply	63	**20**	40	10	17	6	4	6
Inadequate water for hose streams and sprinklers	51	**3**	34	...	8	3	...	9
Insufficient hydrants	36	**27**	23	11	11	2	5	11
Equipment and Manpower								
Insufficient equipment	140	**62**	21	48	25	20	17	71
Insufficient manpower	94	**9**	27	33	10	7	3	23
Manpower not properly trained	45	**12**	17	13	11	4	3	9
Fire Fighting								
Heavy smoke	106	**64**	34	63	30	8	1	34
High winds	81	**36**	34	20	18	6	3	36
Explosions preceding fire	78	**12**	57	12	10	2	1	8
Explosions during fire	71	**29**	33	23	15	3	...	26
Access impeded by blank walls	34	**32**	13	30	9	...	...	14
Flowing flammable liquids	31	**4**	21	1	5	1	...	7

Table II

List of 1958 Large Loss Fires By Occupancies

Asterisk (*) Before Date Indicates Fire Spread to Other Buildings

The Large Loss Industrial Fires of 1958

	Total No. of Fires	Total No. Killed	Total No. Injured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	82	15	196	$50,945,000	$3,731,000
Canadian Losses	3	0	1	1,315,000	0
Total Losses	85	15	197	$52,260,000	$3,731,000

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References: Story of Fire	Page References: Photo of Fire
	Battery Manufacturing Plants						
*Aug. 9	Dallas, Texas, Continental Battery Mfg. Corp, et al	...	6	$266.0	...	...	...
	Brick, Tile and Pottery Plants						
May 9	near Newcomerstown, Ohio, The Goshen Brick & Clay Corp.	...	1	350.0	$ 83.0	311	311
Sept. 15	St. Louis, Mo., W. S. Dickey Clay Manufacturing Co.	...	...	295.0	140.0	...	259
*Dec. 7	Compton, Calif., Treasure Craft Co., et al	...	2	282.5	...	...	245
	Chemical Plants						
Jan. 15	near Kalamazoo, Mich., The Upjohn Co.	...	3	290.0	...	306	306
*May 23	near Birmingham, Ala., Virginia Carolina Chemical Co.	...	1	500.0	...	...	...
Nov. 7	Linden, N. J., Merck & Co.	...	4	250.0	50.0	...	...
Nov. 25	Geismar, La., Wyandotte Chemical Corp.	...	4	1,750.0	...	296	...
	Concrete Mixing Plant						
*Mar. 11	Melochville, P. Q., Canit Construction Ltd., et al	...	...	413.0	...	...	...
	Electric Generating Plants						
Jan. 31	Port Washington, Wisc., Wisconsin Electric Power Co.	...	...	250.0	...	292	...
July 22	Center Twp., Ohio, American Electric Power Co., Inc.	...	...	250.0	...	320	...
	Fertilizer Plants						
Mar. 13	Norwalk, Conn., The S. & Y. Building Corp.	...	18	309.0	26.0	260	...
*Mar. 15	Jonesport, Me., Maine Peat Moss, Inc.	...	...	250.0	...	...	...
	Food and Food Products						
	Bakeries						
Feb. 9	Fairbanks, Alaska, Sanfair Bakery	...	1	300.0	...	...	...
	Canneries						
*May 30	Ogden, Utah, Royal Canning Corp.	...	2	384.0	45.0	...	...
Dec. 18	East Gwillimbury Twp., Ont., Federal Farms Ltd.	...	...	500.0	...	240	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
Flour and Feed Mills							
*Jan. 8	Franklin, Tenn., Lillie Mills	...	...	$410.0	...	302	301
Jan. 9	Huntington, W. Va., Gwinn Brothers and Company	...	...	465.0	$110.0	...	300
Mar. 3	near Albany, N. Y., Co-operative G. L. F. Exchange, Inc.	2	21	270.5	512.5	284	284
*Oct. 2	Colton, Calif., Pillsbury Mills	...	1	335.0	...	...	269
Fruit Packing							
June 26	Duarte, Calif., H. & M. Banana Co.	...	...	260.0	...	238	...
Oct. 3	Yakima, Wash., Rainier Fruit Company	...	1	430.0	...	...	...
Dec. 4	Tampa, Fla., Ingram Fruit Co.	...	...	270.0	...	...	...
Sirup Manufacture							
*Jan. 20	Cleveland, Ohio, Fountain Specialties Co., et al	...	4	312.5	20.0	244	...
Soybean Processing							
Apr. 23	Rossford Village, Ohio, General Mills Corp., Soybean Division	...	2	250.0	...	...	...
*Sept. 8	Grand River, Ohio, A. E. Staley Mfg. Co.	...	5	500.0	...	...	...
Sugar							
Sept. 26	Philadelphia, Pa., Penna. Sugar Refining Co.	1	...	250.0	...	...	...
	Gas Manufacturing						
Mar. 30	Texas City, Texas, Union Carbide Chemicals Co.	3	...	2,219.0	...	299	...
	Glass Works						
Jan. 6	St. Mary's, W. Va., Marble King, Inc.	...	...	270.0	...	...	...
	Leather Working						
*Jan. 9	Montreal, P. Q., Windsor Shoe Co.	...	1	402.0	...	...	...
Oct. 19	Berlin, Wisc., Berlin Glove Co.	...	...	387.0	61.5	...	...
	Metalworking						
Aircraft Assembling							
Feb. 17	Santa Monica, Calif., Douglas Aircraft Co., Inc.	...	...	560.0	...	263	...
Aluminum Fabrication							
Apr. 9	Barberton, Ohio, Alside Aluminum Co.	...	5	1,290.0	750.0	244	...
Dec. 16	Indianapolis, Ind., Splendor, Inc., et al	...	5	343.5	...	...	...
Aluminum Refining							
Aug. 22	Baton Rouge, La., Kaiser Aluminum and Chemical Corp.	...	...	250.0	...	303	...
Electrical Appliances, Equipment							
May 16	Los Angeles, Calif., Zinsco Electrical Products Co.	...	...	1,048.0	240.0	294	...
Foundries							
Feb. 19	McCook, Ill., Reynolds Metals Co.	6	40	688.0	138.0	282	282
May 21	Fowlerville, Mich., Utilex Div. of Hoover Ball & Bearing Co.	...	...	580.0	150.0	...	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
Aug. 5	Salem Twp., Mich., Peerless Industries	...	...	$500.0	...	...	246
Dec. 17	Bucyrus, Ohio, Miller Mfg. Co.	...	...	700.0	Yes	...	313
Repair Shops							
Oct. 8	Williamsport, Pa., Reading Railroad	...	1	326.0	...	...	302
Dec. 24	Mobile, Ala., Mobile Ship Repair, Inc.	..	2	405.0	$50.0	...	...
Steel Fabrication							
Feb. 3	Louisville, Ky., R. C. Tway Co., Inc., et al	...	...	660.0	144.0	268	269
*Feb. 13	Cicero, Ill., Strom Steel Ball Co., et al	...	...	3,450.0	300.0	251	252
Feb. 27	Wilmington, Ohio, Farquhar Furnace Co.	...	...	301.0	...	250	250
Mar. 15	Genoa, Ill., Falls Products, Inc.	..	1	400.0	...	262	...
Apr. 1	Kent, Ohio, Twin Coach Co.	...	3	250.0	...	...	...
*Apr. 4	near Edgerton, Ohio, Robinair Mfg.	...	...	463.0	46.0	...	...
Apr. 12	Monrovia, Calif., Chem-Therm Mfg. Co., Inc., et al	...	...	296.5	61.0	242	243
Apr. 23	Chattanooga, Tenn., M. M. Hedges Mfg. Co.	...	6	410.0	50.0	249	249
June 29	Walden, N. Y., Wallkill Machine Works, Inc.	...	1	422.0	...	...	...
Aug. 14	Granite City, Ill., Granite City Steel Co.	...	...	300.0	...	...	...
Aug. 18	near Shreveport, La., Hycalog, Inc.	..	...	260.0	...	...	...
Nov. 15	near Jonesboro, Ga., Low Temp Mfg. Co.	...	...	350.0	...	...	...
	Mining						
*Sept. 1	near Hailey, Ida., Apache Mining Co.	...	...	250.0	...	...	...
	Multiple Occupancy Manufacturing						
Jan. 4	Brooklyn, N. Y., Neptune Plastics, et al	...	12	260.5	7.0	...	266
*Feb. 11	Rochester, N. Y., Nerfain, Inc., et al	...	...	445.0	20.0	272	307
	Paint & Varnish						
May 21	near Des Plaines, Ill., All Weather Steel Products Co.	...	1	337.0	...	...	...
	Paper Working						
Feb. 1	Elnora, Ind., Elnora Paper Converters, Inc.	...	...	299.0	...	242	242
*Feb. 22	Tampa, Fla., Crown Zellerbach Corp., et al	...	...	460.0	...	286	...
Nov. 14	Bayonne, N. J., Garden State Container Corp.	...	2	1,400.0	...	309	290, 308
*Dec. 23	Mt. Gilead, N. C., Montgomery Paper Box Co., et al	...	7	300.0	...	...	...
	Printing Plants						
Feb. 16	Dixon, Ill., Dixon Publishing Co.	...	...	725.5	...	...	309
June 14	Whittier, Calif., Whittier News	...	1	468.0	70.0	...	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
	Refineries — Petroleum						
Feb. 15	Alma, Mich., Leonard Refineries, Inc.	1	4	$ 500.0	...	320	...
May 22	Signal Hill, Calif., Hancock Oil Co.	2	18	9,000.0	...	320	320
Oct. 1	Baton Rouge, La., Esso Standard Oil Co.	...	...	2,250.0	...	...	...
	Stone Working						
Jan. 27	Walworth, Wisc., Perfect Seal Manufacturing Co.	...	2	337.5	$50.0	262	262
June 8	near Monon, Ind., Monon Crushed Stone Co., Inc.	...	1	341.0	...	313	...
	Textile Working						
May 6	Pinckneyville, Ill., Superb Garment, Inc.	...	...	255.0	...	286	...
May 31	Des Moines, Iowa, Des Moines Fibre Products	...	2	290.0	...	...	...
Nov. 18	Asheville, N. C., Avon Yarn Mills, Inc., et al	...	1	306.0	...	...	...
	Woodworking						
Building Supplies							
Apr. 1	Hallsboro, N. C., W. M. Ritter Lumber Co.	...	...	250.0	...	...	...
*June 21	Baltimore, Md., Western Mill & Lumber Co.	...	3	250.0	...	...	...
Furniture Factories							
*May 21	Chicago, Ill., Majestic Wood Carving Co.	...	...	250.0	12.5	308	...
Saw and Planing Mills							
Feb. 20	near Klamath Falls, Ore., Car-Ad-Co Co.	...	...	313.0	...	296	267
*May 20	Seattle, Wash., Seattle Cedar Lumber Mfg. Co.	...	...	2,000.0	...	315	...
*June 7	near Boswell, Pa., Boswell Lumber Co.	...	10	250.0	...	...	...
*July 28	near Coeur d'Alene, Ida., Northwest Timber Co.	...	1	577.0	150.0	297	298
*Aug. 17	near Council, Ida., Boise Cascade Lumber Co., et al	...	...	521.0	...	296	...
*Oct. 12	Town of Rutland, Vt., Congdon Lumber Co.	...	...	253.0	...	...	314
Wood Products							
Feb. 4	New Orleans, La., Lester J. Danner, Inc.	...	4	335.0	...	...	...
*June 16	Fort Wayne, Ind., General Industries, Inc.	...	...	314.0	135.0	274	274
*June 28	Guilford, Me., Hardwood Products Co.	...	5	752.0	259.5	294	294
*Nov. 30	Los Angeles County, Calif., Howard Ladder Co., et al.	...	...	410.0	50.0	280	...

Table II (Continued)

The Large Loss Mercantile Fires of 1958

	Total No. of Fires	Total No. Killed	Total No. Injured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	70	8	213	$32,346,000	$1,873,500
Canadian Losses	11	1	76	4,821,000	0
Total Losses	81	9	289	$37,167,000	$1,873,500

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References: Story of Fire	Page References: Photo of Fire
	Automobile Salesrooms						
*Jan. 9	Harvey, Ill., Edsel Sales & Service, et al	...	...	$ 276.0	...	...	288
Aug. 3	Clifford, Pa., Dean Johnson, Inc.	...	4	500.0	...	...	...
	Clothing and Dry Goods Stores						
*Mar. 6	Sheldon, Iowa, Ellerbrock Ready-to-Wear, et al	...	1	314.5	...	...	...
Apr. 3	Amarillo, Texas, Blackman Bros., Inc. et al	...	2	805.0	$370.0	241	...
Aug. 1	Passaic, N. J., Strand Shop, et al	...	2	350.0	...	...	...
Dec. 24	Norton Twp., Ohio, Kiddie Kastle Store, et al	...	...	250.0	...	...	...
	Department Stores						
*Feb. 9	Jacobus, Pa., Bruce V. Smith's Shopping Center, et al	...	4	254.0	...	316	...
Feb. 11	Kansas City, Kan., Young's Department Store	...	4	545.5	115.0	...	...
Feb. 18	Baltimore, Md., Sandler's, Inc.	...	...	538.0	...	259	...
Feb. 25	Springfield, Mass., Youth Center Inc.	...	7	451.0	...	...	...
Mar. 22	Copperhill, Tenn., Smelter Dept. Store	...	...	500.0	...	...	...
May 20	Savannah, Ga., Leopold Adler Company, et al	...	8	844.0	...	255	254
June 18	Boise, Ida., Mode Department Store	...	5	623.5	Yes	...	256
June 26	Dayton, Ohio, Ray's Department Store	...	17	650.0	125.0	...	...
July 22	Stockton, Calif., Smith & Lang, Inc.	...	...	2,434.0	370.0	289	289
Aug. 14	Asheboro, N. C., Hudson Belk Co.	...	...	263.0	...	264	...
Oct. 21	Elizabeth, N. J., Sears, Roebuck and Co.	...	15	275.0	...	...	...
	Five Cent to a Dollar Store						
Sept. 2	Oshawa, Ont., F. W. Woolworth Co., Ltd. et al	...	9	250.0	...	239	...
	Furniture Stores						
*Jan. 15	Levis, P. Q., P. T. Legare Co., et al	...	4	385.5	...	...	...
Feb. 12	Levittown, N. Y., Henshaw Furniture Store	...	18	400.0	...	...	...
Mar. 10	Cleveland, Ohio, Economy Furniture Co., et al	...	2	284.0	40.5	...	...
July 9	Quebec, P. Q., Terreau & Racine Ltd.	...	17	507.0	...	238	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect Loss – Thousands	Page References Story of Fire	Page References Photo of Fire
*Sept. 15	Pekin, Ill., Cohen Furniture Co., et al	...	2	$504.5	$100.0	...	272
Sept. 25	Richmond, Va., Everett Waddy Co.	...	...	283.0	...	...	...
*Dec. 2	Bristol, Va., Home Furniture Co., et al	...	...	400.0	...	...	..
	Grocery Store						
Nov. 11	Evansville, Ind., Penny Can Market, Inc., et al	...	2	250.0	125.0	265	265
	Hardware Stores						
Jan. 1	Decatur, Ill., Moorehouse & Wells Co.	...	5	330.0	...	...	277
*Jan. 5	Madison, Wisc., Multiple Gas Explosion	2	...	285.5	...	311	...
*Feb. 4	Joliette, P. Q., Louis Desrochers and Sons, et al	...	...	748.5	...	251	251
Feb. 7	St. John's, N. F., Canadian Pittsburgh Industries, et al	...	...	300.0	...	...	...
*Feb. 24	Vergennes, Vt., Adams Hardware Store, et al	...	...	500.0	...	265	...
*Mar. 23	Poughkeepsie, N. Y., Home Harmony Store, et al	...	9	289.5	...	...	...
*Apr. 14	Wildwood, N. J., Staller's Hardware, et al	...	4	305.0	...	...	286
July 14	Streator, Ill., Williams Hardware Co.	6	4	600.0	...	282	282
*Oct. 22	Batesville, Ark., C. T. Robertson Hardware Co., et al	...	...	250.0	...	...	...
Dec. 31	Garden City Park, N. Y., Globe Nassau Supply Co.	...	8	400.0	...	...	...
	Multiple Occupancy Stores						
Jan. 1	Ketchikan, Alaska, Ferris Building	...	2	500.0	Yes	...	...
*Jan. 5	Pen Argyl, Pa., Realty Building, et al	...	2	480.0	...	...	287
*Jan. 8	Nampa, Ida., Stone Poultry Co., et al	...	...	420.0	Yes	312	312
Jan. 10	Lodi, N. J., Frankie's Market	...	...	600.0	...	305	...
*Feb. 6	Summerside, P. E. I., MacArthur Block, et al	...	1	500.0	...	...	...
Feb. 10	Milwaukee, Wisc., Joe Goldman, Inc., et al	...	18	338.5	53.0	...	317
*Feb. 19	Washington, D. C., Western Auto Co., et al	...	4	301.5	...	...	271
Feb. 23	Glen Cove, N. Y., W. T. Grant Store, et al	...	9	345.0	...	...	...
*Mar. 4	Calais, Me., State Theatre	...	...	300.0	...	293	...
*Mar. 6	Orillia, Ont., Shreibman's Dept. Store, et al	...	...	500.0	...	...	...
*Mar. 17	Clearwater, Fla., Harrison Bldg., et al	...	...	505.0	...	...	237
Mar. 21	Pine Brook, N. J., Pine Brook Auction Mart	...	...	400.0	...	...	...
May 8	Columbus, Ohio, Parkey's Tavern, et al	...	8	462.5	120.0	...	...
May 13	Caldwell Township, N. J., Union-OP, et al	...	...	800.0	...	...	...
Aug. 5	San Francisco, Calif., Western Merchandise Mart, et al	...	...	1,000.0	...	276	...
Aug. 24	near West Palm Beach, Fla., Farmers Market	...	...	600.0	...	...	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
Sept. 12	Atlanta, Ga., Forsyth Corp.	...	6	$290.0	...	...	...
Sept. 29	Patchogue, N. Y., Hamburger Choo-Choo, et al	...	...	392.5	...	...	...
Oct. 7	Atlantic City, N. J., Emerson Richards, et al	...	3	500.0	...	...	...
*Oct. 25	Ottawa, Ont., Addressograph-Multigraph Co., et al	1	36	600.0	...	...	...
*Nov. 13	Gallipolis, Ohio, David-Schuler Dept. Store, et al	...	...	305.5	...	...	...
Nov. 14	Dallas, Texas, Thrift-Tee Food Basket, et al	...	...	265.0	...	...	...
Nov. 18	Colfax, Wash., Tick Klock Drug Co., et al	...	3	306.5	$8.5	...	...
Nov. 25	Morristown, N. J., Elblum Holding Corp., et al	...	6	300.0	...	...	...
Nov. 26	Colorado Springs, Colo., Colorado Springs Music Co.	...	...	428.0	15.0	...	...
*Nov. 29	Belleville, Ont., Wm. Deline Co., Ltd., et al	...	1	480.0	...	283	...
*Dec. 2	Baker, Ore., Levinger's Rexall Store, et al	...	...	475.0	...	273	273 335
Dec. 5	Joliet, Ill., Adlers Groceries	...	4	285.0	...	...	...
Dec. 13	Waterloo, Iowa, Uhlig Jewelry Store, et al	...	...	250.0	...	...	...
Dec. 14	Ridley Twp., Pa., Bargain City, USA	...	...	350.0	...	...	...
Dec. 25	Toronto, Ont., Stage Door Tavern	...	8	300.0	...	...	...
*Dec. 26	Lake Charles, La., Kaufman Building, et al	...	...	375.0	...	...	...
	Restaurants						
Jan. 25	Hempstead, N. Y., Nassau Bar & Grill, et al	...	4	500.0	...	...	...
May 9	near Knoxville, Tenn., C'est Bon	...	2	291.5	42.5	305	241
May 13	Lincolnwood, Ill., Allgauer's Fireside Restaurant	...	2	600.0	...	238	...
*June 3	Syracuse, N. Y., Dans 482 Club, et al	...	6	365.5	...	276	...
	Shopping Centers						
Jan. 25	near Toledo, Ohio, W. T. Grant Co., et al	...	1	734.0	18.0	248	...
July 24	Houston, Texas, Gulfgate Shopping City	...	...	731.0	121.0	263	...
Dec. 29	Scranton, Pa., Davidow Bldg.	...	3	1,000.0	...	...	...
	Supermarkets						
Feb. 25	near Clarksburg, W. Va., Thorofare Food Market, et al	...	1	300.0	...	268	...
Mar. 7	Detroit, Mich., Great Scott Super Market	...	...	294.0	...	240	...
May 1	near Jacksonville, Fla., Jacksonville Meat Co.	...	...	350.0	...	...	314
June 7	Dallas, Texas, Wyatt Food Stores, Inc.	...	2	250.0	...	...	...
Oct. 14	Los Angeles, Calif., Hiram's Market, Inc.	...	4	400.0	250.0	305	303
Dec. 7	St. Vital, Manit., Canada Safeway Stores	...	...	250.0	...	...	...

Table II (Continued)

The Large Loss Storage Fires of 1958

	Total No. of Fires	Total No. Killed	Total No. Insured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	39	9	142	$19,035,000	$ 153,500
Canadian Losses	4	0	9	2,099,000	0
Total Losses	43	9	151	$21,134,000	$ 153,500

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References: Story of Fire	Page References: Photo of Fire
	Building Material Warehouses						
Jan. 9	Detroit, Mich., Mohawk Lumber & Supply Co.	...	3	$292.0	...	...	...
*Jan. 18	Irvington, N. J., Solondz Bros. Lumber Co.	...	...	360.0	$ 75.0	...	...
Jan. 21	Hopkinsville, Ky., Cayce Mill Supply Co.	...	3	251.5	...	...	...
July 2	Chicago, Ill., Gee Lumber Co.	...	...	717.5	...	...	244
*Aug. 21	Ellsworth, Me., Ellsworth Builders Supply Co.	...	4	300.0	...	...	...
Aug. 31	Gypsum, Ohio, Celotex Corp.	...	3	500.0	...	...	...
	Cold Storage						
Jan. 16	Richmond, Va., Merchants Ice & Cold Storage Co.	7	1	1,000.0	...	...	283
Apr. 25	Philadelphia, Pa., Gaudio Bros.	...	...	281.5	...	...	...
Sept. 18	Trenton, Ont., Central Cold Storage, Ltd.	1	...	319.0	...	...	...
	Cotton Storage						
Jan. 31	Memphis, Tenn., Federal Compress and Warehouse Co.	...	...	323.0	...	293	...
*Feb. 25	Smithfield, N. C., Farmers Cotton Warehouse	...	...	413.5	...	...	...
Apr. 13	near McFarland, Calif., Camp & Felder Cotton Compress	...	...	491.0	...	...	...
	Drug Warehouse						
Sept. 28	Boise, Ida., Gem State Wholesale Drug Co.	...	2	415.5	Yes	243	...
	Electrical Equipment Warehouse						
June 29	Los Angeles County, Calif., Radio Corp. of America	...	1	577.0	Yes	246	...
	Fireworks Storage						
*July 5	near Portland, Ore., Signal Fireworks and Specialty Co.	1	26	250.0	...	245	...
	Food and Grocery Warehouses						
Mar. 21	near Nashville, Tenn., Kroger Company	...	...	300.0	...	...	279
Apr. 19	Little Rock, Ark., Kimbell's Wholesale Grocery	...	4	490.0	...	...	...
	Furniture Warehouses						
Jan. 29	College Point, N. Y., North American Aluminum Corp.	...	23	750.0	...	...	...
Apr. 20	Greenville, S. C., Emaxcee Building, et al	...	...	561.5	...	271	...
June 19	Barrie, Ont., M. J. Campbell	...	4	380.0	...	...	...
Oct. 27	Tampa, Fla., Galloway Mfg.	...	1	265.0	...	278	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
	Hardware Warehouses						
Apr. 19	Syracuse, N. Y., Drennan Steel Products Corp.	...	2	$381.0	...	...	...
Aug. 17	Seattle, Wash., Bowles Plumbing Supply	...	...	317.5	...	...	...
	Leather and Leather Products Storage						
Jan. 22	Los Angeles, Calif., Solnit Shoe Co.	...	...	732.5	$50.0	317	318
	Liquor Storage						
July 1	Bridgeport, Conn., L. Herman Lavit Co., Inc.	...	5	440.0	...	...	...
	Machinery Warehouse						
Apr. 28	near Ogallala, Neb., Cater Construction Co.	...	...	250.0	...	247	295
	Military Storage						
June 19	Yuma, Ariz., Vincent AFB	...	...	406.0	...	...	...
July 19	Nashville, Tenn., U. S. Army	...	4	250.0	...	...	...
	Miscellaneous Storage						
Feb. 13	Erie, Pa., M. V. Irwin Co.	...	2	2,180.0	...	264	264
Oct. 3	Ketchikan, Alaska, Oxenberg Bros.	...	2	300.0	...	...	239
Oct. 29	Sault Ste. Marie, Ont., Mannesman Tube Co., Ltd.	...	...	400.0	...	302	...
Nov. 23	Fort Lee, N. J., New England Industries, Inc.	...	3	350.0	...	...	...
Dec. 12	Hamilton, Ohio, Hamilton Skotch Corp.	...	...	325.0	...	276	...
*Dec. 26	San Francisco, Calif., Whitney's at the Beach, et al	...	5	250.0	...	...	...
	Paper Warehouse						
July 1	Asheville, N. C., Champion Paper & Fibre Co.	...	45	790.0	...	...	280
	Rag Storage						
Feb. 13	Cincinnati, Ohio, Queen City Industries	...	1	282.0	4.0	259	...
	Rubber and Rubber Products Storage						
Feb. 18	Chelsea, Mass., American Biltrite Rubber	...	...	450.0	...	...	...
	Sisal Warehouse						
Apr. 14	Gulfport, Miss., U. S. Gov't.	...	...	489.5	...	299	...
	Terminal Warehouses						
June 4	near Orange, Texas, Orange County Nav. Port District	...	2	435.0	...	237	...
Dec. 17	Montreal, P. Q., J. B. Baillargeon Express	...	5	1,000.0	...	...	...
	Textile Warehouses						
Jan. 5	Louisville, Ky., Enro Shirt Co., Inc.	...	...	730.0	†	291	...
Mar. 1	Cleveland, Ohio, Bartlett & Lapine Co., et al	...	...	537.5	24.5	...	...
	Tobacco Warehouse						
Dec. 24	Mount Joy, Pa., Lancaster Leaf Tobacco, Inc.	...	...	600.0	...	271	...

† Property damage figure includes U. & O., as breakdown is not available.

Table II (Continued)

The Large Loss Residential Losses of 1958

	Total No. of Fires	Total No. Killed	Total No. Injured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	6	2	11	$2,289,500	$ 18,000
Canadian Losses	4	0	0	1,249,000	125,000
Total Losses	10	2	11	$3,538,500	$ 143,000

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect Loss – Thousands	Page References: Story of Fire	Page References: Photo of Fire
	Apartment Buildings						
*Feb. 18	Logan, Ohio, Johnson Bldg.	...	...	$371.0	...	260	...
Mar. 10	International Falls, Minn., Thompson-Kendall	...	...	301.5	$ 18.0	...	238
May 12	Trenton, Ont., Beamish Department Store, et al	...	...	250.0	...	...	...
	Hotels						
Continuous Operation							
*Jan. 4	Berwick, Pa., Hotel Morton	2	6	359.0	...	...	256
Apr. 26	Peterborough, Ont., Empress Hotel, et al	...	...	450.0	...	277	260
Oct. 11	Uranium City, Sask., Uranium City Hotel, Ltd.	...	...	250.0	...	275	...
Nov. 19	Lac Beauport, P. Q., Hotel Manoir St. Castin	...	...	299.0	125.0	298	292
Seasonal Operation							
Mar. 15	Asbury Park, N. J., New Lafayette Hotel	...	1	258.0	...	...	...
*Nov. 20	Old Orchard Beach, Me., Palmer Hotel, et al	...	2	250.0	...	...	255
*Dec. 11	Gloucester, Mass., The Oceanside Hotel, Inc.	...	2	750.0	...	270	270

The Large Loss Church Fires of 1958

	Total No. of Fires	Total No. Killed	Total No. Injured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	4	0	1	$1,166,000	0
Canadian Losses	0	0	0	0	0
Total Losses	4	0	1	$1,166,000	0

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect Loss – Thousands	Page References: Story of Fire	Page References: Photo of Fire
	Churches						
Jan. 1	Webster Groves, Mo., Webster Groves Presbyterian Church	...	...	$265.0	...	...	...
Jan. 8	Union, S. C., Tabernacle Baptist Church	...	...	250.0	...	240	240
Jan. 12	Houlton, Me., St. Mary's Roman Catholic Church	...	1	400.0	...	...	...
Dec. 30	Boston, Mass., Bethany Baptist Church	...	...	251.0	...	...	...

Table II (Continued)

The Large Loss Educational Fires of 1958

	Total No. of Fires	Total No. Killed	Total No. Injured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	16	0	27	$6,281,000	0
Canadian Losses	1	0	1	287,000	0
Total Losses	17	0	28	$6,568,000	0

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
	Colleges and Universities						
Jan. 23	Loretto, Pa., St. Francis College	...	...	$280.0	...	258	258
May 17	Columbus, Ohio, Ohio State University Armory	...	6	326.0	...	...	...
	Parochial Schools						
Jan. 18	East Chicago, Ind., St. Stanislaus School, et al	...	4	500.0	...	270	...
Nov. 11	Sturgeon Falls, Ont., Sacred Heart, St. Joseph's School	...	1	287.0	...	...	315
	Public Schools						
Feb. 5	Enterprise, Calif., Enterprise High School	...	...	318.5	...	...	...
Feb. 6	Clinton, Mass., Clinton High School	...	...	352.5	...	273	...
Feb. 13	near Lancaster, Ohio, Boys' Industrial School	...	1	500.0	...	...	...
Feb. 20	Charleston, Tenn., Charleston High School	...	...	275.0	...	...	...
Feb. 24	near Pawnee, Ill., Community Unit School District	...	...	257.0	...	...	...
Mar. 9	Dayton, Ohio, McKinley Public Occupational School	...	...	350.0	...	...	...
Apr. 6	Swarthmore, Pa., Swarthmore-Rutledge-Union School District	...	...	450.0	...	248	...
June 1	Burns, Ore., Burns Union High School	...	1	542.0	...	...	...
June 24	Bemidji, Minn., Central School	...	1	375.0	...	...	...
July 25	Providence, R. I., Providence Public School Administration Office	...	12	800.0	...	239	239
Oct. 31	near Charlotte, N. C., Oakhurst Elementary Public School	...	...	260.0	...	...	268
Nov. 9	Jefferson, Texas, Jefferson High School	...	...	275.0	...	246	...
*Dec. 17	Whiteville, N. C., Whiteville High School	...	2	420.0	...	...	...

Table II (Continued)

The Other Large Loss Fires of 1958 (Excluding Transportation)

	Total No. of Fires	Total No. Killed	Total No. Injured	Total Property Damage Loss	Total Insured Indirect Loss
U. S. Losses	50	9	223	$25,498,500	$ 185,500
Canadian Losses	11	2	20	7,567,000	0
Total Losses	61	11	243	$33,065,500	$ 185,500

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References: Story of Fire	Page References: Photo of Fire
	Amusement Places						
Feb. 8	Swansea, Ont., Kingsway Club	...	...	$450.0	...	...	...
*Feb. 26	Norfolk, Va., Ocean View Amusement Park	...	45	309.5	...	...	...
June 8	near Tulsa, Okla., Tulsa State Fairgrounds	...	...	609.5	...	...	...
July 6	Amherst, N. S., Maritime Winter Fair, et al	...	...	633.0	...	242	...
Nov. 29	Bainbridge Twp., Ohio, Grandview Raceways, Inc.	...	...	515.0	...	298	299
*Dec. 24	Clinton, Iowa, The Modernistic Ballroom et al	...	1	613.0	...	275	275
	Bowling Alleys						
Feb. 10	West Islip, N. Y., Captree Bowling Alleys	...	...	1,053.0	...	...	...
Apr. 2	Ridgway, Pa., Aiello's Amusement Co.	...	1	366.0	...	...	...
Apr. 7	near Yakima, Wash., Yakima Skookum Bowl	...	...	250.0	...	...	...
May 14	Detroit, Mich., Twenty Grand Recreation	...	...	250.0	Yes	...	...
	Buildings Under Construction						
May 13	Oshkosh, Wisc., Commodity Storage Corp.	...	5	322.0	...	243	...
*Dec. 15	Sherbrooke, P. Q., Raby & Freres	2	20	250.0	...	...	284
	Clubs						
City							
Jan. 1	Wenatchee, Wash., Elks Temple	...	1	306.5	...	...	...
Feb. 16	Jackson, Mich., Moose Lodge	...	2	391.0	...	313	...
Nov. 23	Cleveland, Ohio, Al Koran Shrine	...	...	250.0	...	...	...
Dec. 11	Eugene, Ore., Elks Club	...	...	475.0	...	262	316
Country							
Jan. 8	Flint, Mich., Flint Country Club	...	3	460.0	...	...	304
Night							
Jan. 29	Dayton, Ohio, Varsity Bowl, Inc.	...	...	250.0	$110.0	291	...
	Forest Fires						
June 2	Minchumina Lake, Alaska	...	..	$ 350.0	...	...	...

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
	Forest Fires (Con't)						
July 4	Vancouver Forest District, B. C.	...	...	$ 347.5	$ 85.0**	...	...
July 6	Prince Rupert Forest District, B. C.	...	...	555.0	...	...	...
July 15	Prince George Forest District, B. C.	...	...	315.5	328.0**	...	...
Aug. 2	northwestern Alta.	...	...	2,165.5	...	321	...
Oct. 3	Monrovia, Calif.	...	...	2,000.0	500.0**	321	...
Dec. 2	Malibu Beach, Calif.	...	...	447.5	90.0**	322	322
Dec. 14	Cleveland National Forest, Calif.	1	...	952.5	645.5**	322	...
Dec. 31	Mulholland Fire, Los Angeles County, Calif.	...	...	648.0	82.0**	...	...
	Garage						
*Apr. 19	Birmingham, Ala., Decatur Transit Truck Lines, Inc.	...	1	500.0	...	281	...
	Gas Wells, Pipelines and Storage						
Jan. 12	Indianapolis, Ind., Citizens Gas and Coke Utility Company	...	2	600.0	...	319	319
July 2	Charleston, S. C., South Carolina Electric and Gas Co.	...	1	360.0	...	320	321
Oct. 15	off Louisiana Coast, Continental Oil Co., et al	7	21	1,146.5	...	248	...
	Government Property						
Feb. 3	U. S. Government†	...	...	270.0	...	...	...
	Hangars						
Feb. 17	Malton, Ont., Sanderson Aircraft Ltd.	...	...	626.5	...	...	...
July 13	Rimouski, P. Q., Quebecair, Inc.	...	...	1,408.5	...	311	...
	Laundry						
Mar. 27	Tacoma, Wash., Tacoma Laundry	...	4	399.0	...	257	257
	Lumberyards						
*June 7	Perth Amboy, N. J., Ira R. Crouse Lumber Co., et al	...	13	501.0	...	288	...
*July 1	Vancouver, B. C., E. L. Sauder Co., Ltd.	...	...	292.5	...	...	...
July 5	Hackensack, N. J., Comfort Coal & Lumber Co.	...	2	250.0	...	...	...
*July 23	Corbin, Ky., F. B. Heath Lumber Co., Inc., et al	...	2	250.0	...	291	...
*Nov. 23	Festus, Mo., Waggener Store Co., et al	...	21	383.5	...	288	...
	Marinas						
Jan. 14	McHenry, Ill., North Bridge Marine Service Co.	...	2	570.0	6.5	261	261
*Mar. 13	Essington, Pa., Essington Yacht Yard et al	...	7	300.0	...	...	281
May 30	Sandusky, Ohio, National Machinery Co., et al	...	...	332.0	...	...	...

** Cost of Suppression. (not insured).
† The Federal Fire Council is not at liberty to release the location of this fire.

Table II (Continued)

Date	Place and Occupant	No. Killed	No. Injured	Property Damage Loss – Thousands	Insured Indirect	Page References Story of Fire	Page References Photo of Fire
	Motion Picture Studio						
July 2	Los Angeles, Calif., Samuel Goldwyn Productions, Inc...	...	...	$1,130.0	...	253	252
	Museum						
Apr. 15	New York City, N. Y., Museum of Modern Art.....	1	33	700.0	...	276	267, 276
	Office Buildings						
Jan. 2	Cincinnati, Ohio, Ohio State Bureau of Unemployment...	...	22	394.0	$34.0	...	247
Mar. 8	Oakmont, Pa., Edgewater Steel Co.....	...	12	280.0	35.0	...	...
	Penal Institution						
May 30	Seagoville, Texas, Federal Correctional Institution.....	...	15	425.0	...	...	...
	Petroleum Tank Farm						
Apr. 23	Newport News, Va., Esso Standard Oil Co.....	...	...	800.0	...	...	...
	Piers and Wharves						
Feb. 18	Camden, N. J., Penna. & Reading-Seashore Lines.....	...	...	417.5	...	...	297
Feb. 21	Portsmouth, Va., Seaboard Air Line Ry.....	...	1	345.0	...	...	...
Feb. 26	Boothbay Harbor, Me., Fisherman's Wharf, Inc.....	...	1	300.0	...	...	...
Mar. 7	Portland, Me., Portland Terminal Co.....	...	1	275.0	...	...	...
Sept. 11	Portland, Ore., Waterway Terminals Co.....	...	...	400.0	...	293	...
*Nov. 20	Pensacola, Fla., Pensacola Port Authority, et al.....	...	...	1,268.5	...	...	285
	Public Buildings						
May 9	Galesburg, Ill., Galesburg Public Library.....	...	4	650.0	...	243	...
Dec. 24	Washington, Ga., County Court House.....	...	...	250.0	...	...	...
	Radio Station						
July 21	Battle Creek, Mich., Security National Bank, et al.....	...	...	275.0	...	277	278
	Roundhouses						
Jan 25	St. John's, N. F., Canadian National Railway.....	...	...	523.0	...	...	...
Mar. 23	Chicago, Ill., Belt Railroad of Chicago.....	...	...	658.0	...	...	...
	Vacant Building						
Jan. 1	Chicago, Ill., Abandoned Warehouse.....	...	...	250.0	...	310	310

Table II (Continued)

Large Loss Transportation Fires

	Total No. of Fires	Total No. Killed	Total No. Injured†	Total Property Damage
U. S. Losses	54	215	304	$131,292,000
Canadian Losses	1	2	0	2,500,000
Total Losses	55	217	304	$133,792,000

Aircraft (See Key to Abbreviation, next page)

1958 Date	Place	Type Accident	Operator	Type Aircraft	Estimated Loss	Number Aboard Aircraft	Killed On Ground
Jan. 6	Norfolk, Va.	CF	USN	P4M-1Q	$1,000,000	4	0
Jan. 9	Bohemia, N. Y.	CF	EAL	Constellation	750,000	0	0
Jan. 14	nr. Patuxent, Md.	CF	USN	R7V	1,500,000	9	0
Jan. 27	Quonset, R. I.	GF	USN	2 HSS-1 1 HUL	850,000	1	0
Feb. 8	Westover AFB, Mass.	CF	USAF	B-47	3,052,000	3	0
Feb. 11	Ellsworth AFB, S. Dakota	CF	USAF	B-52	10,017,000	2	3
Feb. 13	Palm Springs, Calif.	CF	WAL	Convair 240	500,000	0	0
Feb. 19	Suffolk County AFB, N. Y.	GF	USAF	F-102A	2,500,000	0	0
Feb. 26	nr. Lancaster, Ohio	CF	USAF	RB-47	2,500,000	4	0
Mar. 1	New Haven, Conn.	GF	AA	Convair 240	250,000	0	0
Mar. 7	Truax Field, Wisconsin	GF	USAF	F-102A	1,200,000	0	0
Mar. 13	Tulsa, Okla.	EF	USAF	B-47	2,500,000	1	0
Mar. 13	nr. Florida City, Florida	EF	USAF	B-47	2,500,000	4	0
Mar. 17	Melbourne, Florida	CF	EAL	404	750,000	0	0
Mar. 22	nr. McClellan AFB, Calif.	FF	USAF	RC-121	2,018,000	0	0
Mar. 25	nr. Miami, Florida	FF	Braniff	DC-7C	1,500,000	9	0
Apr. 9	Rio Linda, Calif.	CF	USAF	F-102	2,300,000	1	0
Apr. 10	nr. N. Collins, N. Y.	EF	USAF	B-47	2,500,000	4	0
Apr. 13	Georgetown, Delaware	CF	USAF	C-133A	9,200,000	4	0
Apr. 15	St. Petersburg, Florida	EF	USAF	B-47	2,500,000	4	0
Apr. 15	Pease AFB, New Hampshire	CF	USAF	B-47	1,874,000	4	0
Apr. 25	nr. Goose AFB, Labrador	CF	USAF	B-47	2,500,000	2	0
May 2	Newark, New Jersey	CF	EAL	DC-7B	500,000	0	0
May 25	Otis AFB, Mass.	GF	USAF	RC-121	2,200,000	0	0
June 2	nr. Travis AFB, Calif.	CF	USAF	C-124A	2,030,000	6	0
June 13	McChord AFB, Washington	FF	USAF	TF-102A	1,400,000	0	0
June 25	nr. Langley AFB, Va.	CF	USAF	B-57	1,000,000	2	0
June 26	Loring AFB, Maine	GF	USAF	B-52	8,000,000	0	0
June 27	nr. Westover AFB, Mass.	CF	USAF	KC-135A	5,000,000	15	0
July 29	Loring AFB, Maine	CF	USAF	B-52	8,000,000	8	0
Aug. 14	McConnell AFB, Kansas	GF	USAF	B-47	637,000	0	1
Aug. 15	Nantucket Airport, Mass.	CF	NEA	Convair	500,000	24	0
Sept. 3	NAAF Charlestown, R. I.	CF	USN	AD-5N	425,000	0	0
Sept. 10	Kirtland AFB, New Mexico	CF	USAF	F-102A	1,190,000	0	2

† Does not include Aircraft injuries.

Table II — Continued

1958 Date	Place	Type Accident	Operator	Type Aircraft	Estimated Loss	Number Killed Aboard Aircraft	Number Killed On Ground
Sept. 16	Hastings, Minnesota	CF	USAF	B-52	$8,000,000	7	0
Sept. 17	Tinker AFB, Okla.	CF	USAF	C-124	1,700,000	0	0
Sept. 29	Little Rock AFB, Ark.	CF	USAF	RB-47E	2,570,000	4	0
Oct. 9	nr. Payette, Idaho	CF	USAF	C-123	750,000	19	0
Oct. 23	Lockburne AFB, Ohio	CF	USAF	B-47	2,500,000	3	0
Oct. 24	Detroit, Michigan	EF	RAF	Vulcan 4	1,000,000*	6	0
Oct. 29	Pine Bluff, Ark.	CF	USAF	B-47	2,500,000	3	0
Nov. 4	nr. Abilene, Texas	FF	USAF	B-47	2,500,000	1	0
Nov. 10	N. Y. International Airport New York	GF	S&W TCA	Constellation Viscount	3,500,000	0	0
Nov. 12	nr. Hunter AFB, Ga.	CF	USAF	KC-97	1,280,000	11	0
Nov. 19	El Toro MCAS, Calif.	CF	USMC	F4D-1	500,000	0	0
Nov. 22	Loring AFB, Maine	CF	USAF	B-47	2,500,000	4	0
Nov. 25	Loring AFB, Maine	CF	USAF	KC-135	3,500,000	5	0
Nov. 26	Chennault AFB, La.	GF	USAF	B-47E	2,270,000	0	1
Dec. 9	Norfolk, Va.	CF	USN	AG-2	1,337,000	4	2
Dec. 10	nr. Altus AFB, Okla.	CF	USAF	B-52	8,000,000	8	0

*No accurate estimate of value of aircraft available; it undoubtedly exceeded $1,000,000.

Key to Abbreviations

Aircraft Type Designations for Military Aircraft are the Official Designations

AA — American Airlines
AFB — Air Force Base
CF — Crash Fire
EAL — Eastern Air Lines
EF — Explosion in Flight
FF — Fire in Flight
GF — Ground Fire
MCAS — Marine Corps Air Station
NAAF — Naval Auxiliary Air Facility
NEA — Northeast Airlines
RAF — Royal Air Force
S&W — Seaboard and Western
TCA — Trans Canada Airlines
USAF — United States Air Force
USMC — United States Marine Corps
USN — United States Navy
WAL — Western Air Lines

Railroad Rolling Stock

Date	Place	Owners or Operators	Estimated Loss	Number Killed	Number Injured
*Jan. 22	Niagara Falls, N. Y.	Niagara Junction Railroad Yard	$1,000,000	...	200
*March 4	Shattuck, Okla.	Sante Fe Railroad	250,000	...	3
*June 1	Mt. Pulaski, Ill.	Illinois Central R. R.	1,000,000	2	40

Ships

Date	Place	Owners or Operators	Estimated Loss	Number Killed	Number Injured
June 25	East River, N. Y.	Empress Bay and MS. Nebraska	$ 662,000	2	36
Aug. 7	Newport Harbor, R. I.	S. S. Gulfoil and S. E. Graham	1,330,000	18	25

Use of Combustible Gas Indicators

by N. W. Hartz

Mine Safety Appliances Company

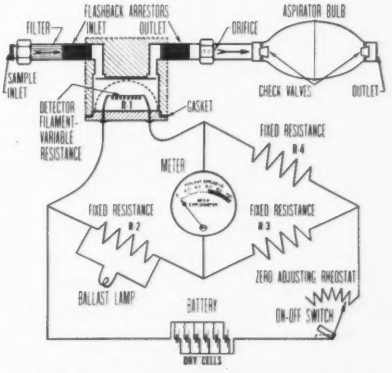
The present, almost universal method of detecting and measuring combustible gases and vapors in air has been in use for approximately thirty years. Although the principle of measurement has remained the same during this period, refinements and variations in design have been made as utilization has grown to more than 100,000 combustible gas analyzers in use today.

Presently available instruments that have been subjected to the close scrutiny of the Underwriters' and Factory Mutual Laboratories are universally accepted as the means for measuring hazards or potential hazards created by the presence of flammable gases in mixtures with air in public utility operations; petroleum production, refining, and marketing; in chemical and petrochemical plants; in the metallurgical industries; in municipal fire department inspections; distilleries; paint and varnish making; marine operations; and a host of other industrial activities.

Hot Wire Indicators

The basic principle of operation of these instruments is a change in the electrical resistance of a hot platinum filament which is caused by the heat of combustion of a sample of the gas-air mixture passing over the filament. The

The Model 2 Mine Safety Appliances Company "Explosimeter" which operates on the hot platinum filament principle.



Schematic wiring and flow diagram of the Model 2 Mine Safety Appliances Company "Explosimeter".

Based on a talk given by the author at the NFPA Fall Conference held in Pittsburgh, Pa., Nov. 17–19, 1958. With the consent of the author, this paper has also been submitted and approved by Johnson-Williams Inc. (Palo Alto, Calif.) and by the Davis Emergency Equipment Co., Inc., (Newark, N. J.), the only two other U. S. manufacturers of Underwriters' Laboratories listed or Factory Mutual approved combustible gas indicators.

filament is one arm of a Wheatstone bridge which provides means for measuring the resistance change. This change is shown by an electrical meter connected across the bridge and calibrated in percentage of the lower explosive limit. Power for operation of this bridge circuit in portable instruments is provided by a dry cell battery, and, in permanently installed continuous analyzers, by normal house current delivered through a transformer and rectifier.

Early instruments of this type were relatively large, cumbersome, and expensive. Large scale usage of such instruments really started around 1937, when the first small-sized instruments appeared which were adjustable by means of a single control knob. These new instruments, priced at approximately half of the earlier versions, were widely accepted. Probably, the most important factor in the acceptance of these new smaller instruments was the adoption by all manufacturers of the practice of calibrating instruments individually for a specific combustible or combustibles, or alternatively, providing a multiple calibration chart for interpolation of true readings. The less complex instruments were designed as general purpose devices and supplied with a basic calibration that was representative of substantially all common combustibles. This is practical, since the heat of combustion at the lower explosive limit concentration of most combustible gases is approximately the same.

Applications for Indicators

Through the intervening years, a number of variations and improvements have been incorporated into such instruments for special applications.

Coal Mine Methane Indicators

As an example, two styles of instruments have been designed to meet the exacting requirements of the United States Bureau of Mines for use in gassy coal mines. These instruments are calibrated so that their dials read percent methane in keeping with the practice of the mining industry. They are powered by the same battery that serves the miners' electric cap lamps.

The M-S-A Methane Tester indicates the percent methane by direct reading on the dial.

Measuring Gases in Manholes, Sewers, etc.

In examining manholes, sewers, and other street openings, a very common application of such instruments, there is frequently a question whether combustible contamination is caused by leakage from a gas distribution system or by leakage of gasoline from an adjacent service station. To enable an instrument user to differentiate between these two kinds of contamination, charcoal filters have been developed for attachment to, or insertion in certain styles of instruments. Another ap-

A modern combustible gas indicator weighs only about 6 pounds and is used for locating leaking gas and testing flammable gas hazards.

The calibration selector switch provides for five alternate settings and the instrument gives readings on any gas for which it has been calibrated.

proach to this problem is reflected in the development of an instrument that electrically differentiates between natural gas and petroleum vapors. Such instruments are equipped with a switch which is normally positioned to operate the instrument detector filament at a temperature sufficiently high to burn natural gas, petroleum vapors, or any other combustible that might be present. In its alternate position, the filament temperature is reduced below that point where natural gas in the sample will burn. By this means, the difference between readings obtained in two tests with this switch in alternate positions reveals the presence of combustibles attributable to natural gas. In instruments equipped with a separate voltage control, the same result can be achieved by reduction of the filament voltage by a controlled amount.

Toxicity Analysis

Because many flammable vapors are also toxic, industrial safety engineers and industrial hygienists have long relied upon combustible gas indicators to measure hazards of toxicity as well as explosibility. In practically all cases, the "Maximum Allowable Concentration" (MAC) for regular exposure of personnel is a very small fraction of the lower explosive limit concentration. To measure reasonably these two hazards with a single instrument, several special versions have been produced.

For use, particularly in the petroleum industry, one instrument variation utilizing a dual range of 0 to 25% of the lower explosive limit and 0 to 100% of the lower explosive limit is used. Since the MAC value for most petroleum hydrocarbons is 500 parts per million, or approximately 4% of the lower explosive limit, this deflection is too small to be read with certainty on a 100% scale, but represents approximately a deflection of $\frac{1}{6}$ the span of a 0 to 25% scale. Operation of this special version is identical with the standard instruments except for the manipulation of the range selector switch.

To measure the dual hazards of toxicity and combustibility in other industries where the threshold concentration for breathing represents a smaller percentage of the lower explosive limit, an even more sensitive instrument is recommended. These are normally equipped with dual scale meters reading from 0 to 10% of the lower explosive limit and 0 to 100% of the lower explosive limit. When readings are taken on the low concentration scale of this instrument, care must be taken that humidity variations are not confused with combustible concentrations. To eliminate this possibility, some such indicators are equipped with refillable dryers, and on others, a special moisture equalizing sample line is used. These overcome the effect of humidity variations, which affect the thermal conductivity of the sample surrounding the filament. Where sample dryers are used, care must be taken that the desiccant or the water it absorbs does not remove the flammable component from the sample, before that sample reaches the detector filaments. This is of particular significance in testing for alcohols and ketones, which are soluble in water.

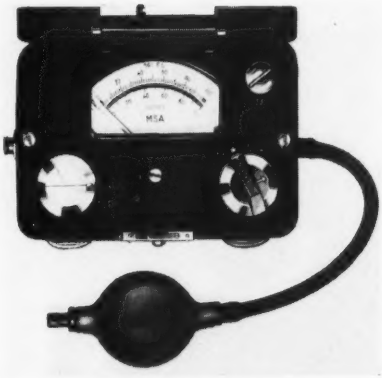
The Davis Emergency Equipment Co., Inc. has this new portable, battery-operated instrument which has one scale indicating 0 to the L. E. L. and a second scale to show gas concentration 0 to 100 percent gas.

The Johnson-Williams, Inc. Model H "Gas-Pointer" is a dual-range indicator having a low range covering gas concentrations from 0 to the lower explosive limit on one range and from 0 to 100 percent natural gas on the second range.

New Dual Purpose Indicator

Thousands of combustible gas indicators are used by gas utility companies for detecting leaks in their underground distribution systems. Until the past few years, leak location in buried pipe systems was accomplished by extending the range of conventional indicators through the use of dilution tubes or valves, to make possible comparative readings of high gas concentrations in bar holes above the leaky section of pipe. These accessories were inconvenient to use and subject to variable performance due to dust accumulation in orifices, wind blowing against an open port, the density of the gas column in the sampling hose, hose resistance due to coiling, and similar variables.

To overcome these difficulties, a new type of instrument was created. This newer device is literally two instruments in one. For leak detection, a combustible gas indicator circuit is used. To measure gas concentrations



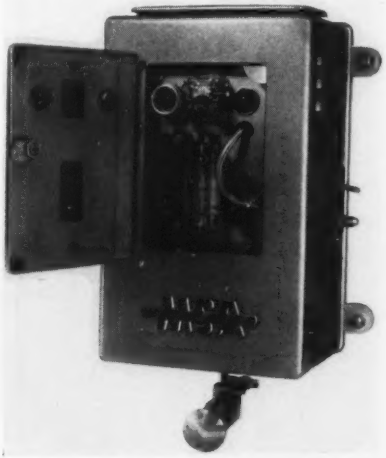
For routine testing of manholes, sewers, etc. the top scale on this M-S-A "Gascope" is used to detect percent of L. E. L. range. By turning the selector, the bottom scale will show the gas concentration by volume.

above the lower explosive limit, a thermal conductivity circuit is employed. A common meter and battery complement serves both circuits. The meter scale is graduated from 0 to 100% of the lower explosive limit and 0 to 100% gas. Such instruments are individually calibrated for the gas with which they will be used. Since their introduction, these instruments have found considerable usage in the petroleum, chemical, and metallurgical industries, and in plants hydrogenating edible oils, for following the progress of purging operations on pipe lines and processing units.

Flame Arresters Used

All of the commercial combustible gas indicators available today are equipped with inlet and outlet flame arresters capable of containing within the filament chamber an explosion of any combustible gas-air mixture encountered. There are a few very rare instances where it is desired to measure hazards that may involve mixtures of gases such as acetylene or hydrogen with oxygen — that is, oxygen in excess of that found in normal air. For those situations, indicators have been built containing special flashback arresters that are capable of containing maximum explosibility mixtures of oxy-acetylene and oxy-hydrogen.

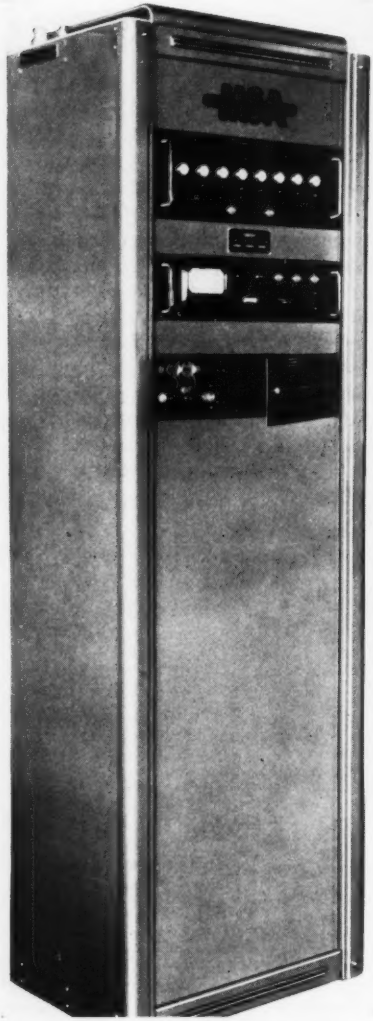
The Davis "Vapotester," Model M-1, Type A for detecting combustible gases other than vapors of leaded gasoline. A type L is available for leaded gasoline vapors.



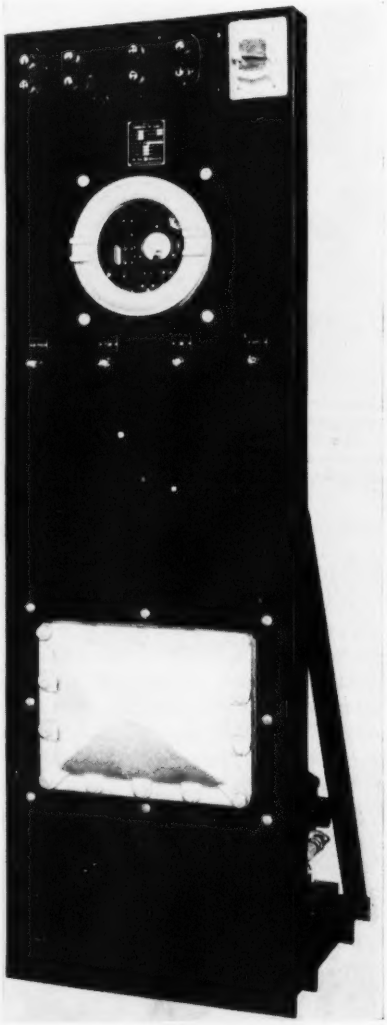
A small, completely self-contained combustible gas alarm marketed by the Mine Safety Appliances Company with the trade name "Explosilarm".

Continuous Combustible Gas Indicators

In addition to the portable instruments that have been discussed thus far, a number of variations have been incorporated into continuous combustible gas indicators. These, too, have been tested exhaustively in the Factory Mutual and Underwriters' Laboratories facilities. Such instruments may today be provided as indicators, alarms, or recorders. Multiple analyzers may be



The M-S-A Combustible Gas Analyzer for measuring continually or intermittently gas samples from one or more locations.



An explosion-proof continuous M-S-A Combustible Gas Analyzer for multi-point sampling and direct meter reading.

incorporated into a system, or one analyzer may be equipped with a valve mechanism to alternatively test a number of locations. Instruments are available in explosion-proof cases for location within hazardous areas, or samples may be withdrawn from such spaces through tubing several hundred feet in length, to analyzers housed in sheet metal cabinets.

Many continuous analyzers are being used to monitor the atmosphere in processing equipment, such as in coating and drying ovens used in making plastic coated fabrics. Here, sample temperatures and humidity may vary widely. To compensate for such variations, special flow systems have been designed which permit exposure of a compensator filament to a very restricted flow of the atmosphere being sampled. This arrangement eliminates variations in reading, due to these changes in sample condition.

In such uses, filaments are continuously exposed to significant combustible concentrations, as contrasted with normal space monitoring where gas is detected only on the occasion of an accidental discharge. As a consequence, in an effort to provide trouble-free service, manufacturers of such devices have undertaken the development of more rugged, longer life filaments. Some of the newest instruments recently introduced to the market are equipped with filaments that have undergone two years of continuous exposure to 50% of the lower explosive limit gas concentration with an accumulated zero drift of less than 5% of the lower explosive limit. This performance is phenomenal by comparison with filaments that have been used in the recent past.

Another recent accomplishment of the instrument industry has been the development of a continuous combustible gas indicator for use in those drying ovens handling high boiling point solvents.

Testing a ship's tank with a Model G, Johnson-Williams "Sniffer". This device is a single range, general purpose combustible gas indicator approved by Factory Mutual Laboratories.

Formerly, the testing laboratories have indicated that the maximum temperature of air sample that could safely be handled by these instruments was of the order of 140°F. This limitation was imposed by reason of the use of plastic insulators in filaments and filament housings. In the newest style instruments, ceramic parts have been substituted for plastics. This has made possible the construction of remote sampling heads for combustible gas analyzers, thermostated to temperatures of the order of 350°F. Such heads can be installed inside or on the outside wall of drying ovens.

Thus far, I have attempted to show that the "hot wire" combustible gas indicators are available in a variety of patterns, and may be adapted to many uses. There are, of course, limitations to the use of such instruments.

Limitations of Hot Wire Indicators

Lead Poisoning

Several years ago, there was much discussion about the possibility of such instruments being poisoned by leaded gasoline. When tetra-ethyl lead is burned on a hot wire, lead oxide is a product of combustion. An accumulation of this material on the surface of the platinum filament will reduce its catalytic activity. Whether or not this reduction in activity takes place is dependent upon the temperature at which the wire is operated. The filaments of all manufacturers do not operate at exactly the same temperature; as a consequence, some instruments are more subject to poisoning by this means than others.

This has led to the introduction of instruments specifically recommended for gasoline service. In these, the filaments operate at a temperature sufficient to volatilize the lead oxide and, thus, avoid poisoning. Another approach has been to pass the gas sample over an "inhibitor" that adds a small concentration of a chlorinated compound to the sample. The chlorinated compound reacts with lead in the combustion chamber to form lead chloride, which has a higher vapor pressure than lead oxide, and this, then, makes possible the use of standard instruments in leaded gasoline service. Frankly, I believe this has been more an academic than a practical problem for us. as makers, and you, as users, of these instruments.

Silicone Poisoning

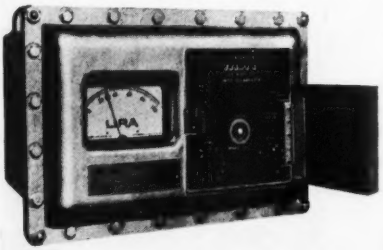
Silicone compounds are finding more and more usage in industry. In the coating of fabrics, to which I previously referred, such materials are sometimes used as anti-foaming agents. It has been found that minute concentrations, less than a part per million, of silicone vapors can rapidly kill the catalytic activity of a platinum filament. In this instance, raising the filament temperature has very little beneficial effect. The use of some of the fluorinated hydrocarbons as inhibitors has shown beneficial effects for a few of the silicone problems, but not many. For this reason, where silicone vapors may be present, I would not recommend the use of a hot wire combustible gas indicator.

Halogenated Hydrocarbons

Similarly, I would be reluctant to recommend a hot wire instrument for an application where it might continuously test air contaminated with significant concentrations of halogenated hydrocarbons. When these are oxidized upon contact with the hot wire, they form halogen acids whose salts deposit on the filament and its supports, and cause significant drift in indication and relatively short filament life.

Infrared Analyzers

It may be interesting to note here that within the past few years, significant progress has been made in adapting nondispersive infrared analyzers to the



This analyzer operates on infra-red absorption of compounds which makes possible identification of the gas. One application is the control of distillation operations. Gases which have no infra-red absorption (such as nitrogen, hydrogen, oxygen, chlorine and the inert gases) cannot be analyzed by this instrument.

measurement of combustibility, specifically for those situations where continuous analysis is desired. During this same interval, the complexity of such analyzers has been reduced, and units have been manufactured which have been sensitized to test for as many as nine different combustibles, whose lower explosive limits have range from as little as 1.5% to 15.0% by volume, and to have equal sensitivity to these materials with respect to percent explosibility within a tolerance of plus or minus 5% of the lower explosive limit.

Summary

In this review, I have attempted to show that many variations and adaptations have been made to conventional combustible gas indicators to better fit them to the applications which have developed for these instruments. On the part of the instrument manufacturers, this has meant a continuous program of improvement and redesign, coupled with research, to find still newer and better methods for measuring the hazard of combustible mixtures.

Future growth and development depends on our continuing mutual cooperation to find the solution to problems relating to the safety of life and property, to which we all are dedicated.

Fire Record of Cities, 1958

As Reported by Municipal Authorities

The following tables summarize fire department reports for 1958 in 655 of the 697 cities with population over 20,000 in the United States and Canada.

These statistics have been collected and published in the April QUARTERLIES since 1939. These tables should not be used as a basis for comparing cities, as a comparison based on these statistics may be misleading if used without a full understanding of the many factors which should be taken into consideration. The principal discrepancy results from the wide variation among fire officials as to what constitutes a fire loss. Certain reports include only insured losses, others only uninsured. Whether or not property is insured has no bearing on the actual value of property destroyed. The chance effect of a single large loss fire, differences in degree of industrialization, in topography, climate and age of cities are some of the factors that influence the fire record. In other words, fire losses reflect the composite results of many factors in addition to fire department efficiency and therefore the practice of making comparisons among different cities based on these data is to be discouraged.

In recent years the 1950 census figures have been used in compiling the statistics for this annual study. In order to increase the accuracy of current figures the population estimates for 1958 were used. The 1957 statistics cited are based on 1957 population estimates.

Fire departments of 552 United States cities and 49 Canadian cities of over 20,000 population have reported their estimates of fire loss, fire alarms, building fires, and false alarms for 1958 to the NFPA Department of Fire Record.

A total of 578 United States cities reported a fire loss for the year 1958 of $225,431,000. Fifty-three Canadian cities reported a loss of $27,606,000.

The average loss per person in the 578 U. S. cities reporting losses was $4.15, 8.1 per cent more than the $3.84 average loss in 1957. The per capita loss in the 53 Canadian cities reporting losses was $4.64, a 14.7 per cent decrease from 1957.

The average loss per building fire in 503 U. S. cities for 1958 was $1,092, compared with $1,085 in 1957, and $1,075 in 1956. The average building fire loss in 43 Canadian cities was $1,155 in 1958, $1,625 in 1957, $1,210 in 1956.

The total number of building fires reported by 583 U. S. cities was 265,263 an average of 3.7 fires per 1,000 population, compared with 3.6 building fires per 1,000 population in 1957. Fifty-two Canadian cities reported 24,470 building fires in 1958. The number per 1,000 population was 3.7 in 1958 as compared with 3.5 in 1957.

Motor vehicle fires reported by 582 U. S. cities totaled 72,737, an average of 1.01 fires per 1,000 population. Fifty-two Canadian cities reported 4,549 motor vehicle fires, or 0.69 per 1,000.

Fire departments in 595 U. S. cities of more than 20,000 population answered 971,965 alarms in 1958. The number of alarms in 54 Canadian cities was 77,045.

In the United States, 590 cities of over 20,000 reported 89,344 false alarms in 1958. This was 9.2 per cent of the total calls. It will be noted that these are "malicious false alarms," not cases where smoke or steam, etc., was honestly mistaken for fire. The 10,332 false alarms reported by 52 Canadian cities were 13.4 per cent of their total calls.

Fire departments have been very cooperative in furnishing fire loss figures. Most of the 42 nonreporting cities did not record their fire experience. A number of loss figures are indicated in the Tables as preliminary estimates.

1958 FIRE LOSSES, CITIES OF 20,000 POPULATION AND OVER

As Reported by Municipal Authorities

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
ALABAMA					
Anniston	45	556	181	49	5.2g
Bessemer	...	...	...	...	..
Birmingham	1,393	4,779	1,216	479	3.3g
Dothan City	191c	446	201	9	9.3
Florence	...	473	150	18	6.3
Gadsden	342	851	232	86	3.4g
Mobile	504c	1,650	690	147	5.4
Montgomery	333	1,302	503	81	2.6
Phenix City	...	252	106	6	3.5g
Selma	53	234	123	7	5.5
Tuscaloosa	139	425	174	22	3.8
ARIZONA					
Phoenix	342a,c	2,916	654	158	2.7g
Tucson	145	1,696	186	107	1.7g
ARKANSAS					
El Dorado	234	342	89	52	3.6g
Fort Smith	433c	890	163	87	3.4
Hot Springs	211	320	138	21	4.3g
Little Rock	1,363c	1,816	569	300	5.7
N. Little Rock	625	1,107	319	11	7.6
Pine Bluff	182d	605	251	5	6.3g
CALIFORNIA					
Alameda	63	704	116	76	1.8
Alhambra	133c	532	148	117	2.6g
Arcadia	373	324	109	11	2.8g
Bakersfield	171c	1,104	212	118	3.9g
Berkeley	352	2,253	563	131	4.7g
Beverly Hills	...	...	...	...	..
Burbank	433	1,255	329	175	4.2
Compton	377	624	164	13	3.4
Eureka	92c	353	57	79	2.0g
Fresno	...	...	...	...	..
Glendale	153	1,047	307	124	2.7g
Huntingt'n Pk.	59	310	106	7	3.5g
Inglewood	90c	896	187	32	2.9g
Long Beach	728c	2,100	891	97	2.8g
Los Angeles	...	36,118	6,863	2,531	2.9g
LosAngelesCty.	...	...	...	...	..
Lynwood	28c	325	60	14	2.3
Menlo Pk. F.D.	216	987	178	40	2.8g
Monrovia	512	408	76	4	3.8
Montebello	95	491	105	23	3.5g
Monterey Park	37	434	59	6	1.7g
National City	45	304	35	4	1.1g
Oakland	1,470	6,617	1,659	869	4.1g
Ontario	29c	925	141	12	3.2g
Oxnard	85c	182	82	4	2.5g
Palo Alto	58	656	208	59	8.3
Pasadena	384	1,032	444	146	4.3
Pomona	65c	785	135	14	3.8
Redondo Beach	92	481	186	11	4.0g
Redwood City	57	750	79	31	3.1
Richmond	436c	1,039	83	62	0.8
Riverside	131c	656	144	17	3.1
Sacramento	881c	2,770	656	249	4.8
San Bernardino	417	1,168	272	108	3.0g
San Diego	808a,c	5,087	1,552	224	3.1g
San Francisco	...	13,022	3,148	2,299	3.8g
San Gabriel	40	156	69	3	3.4
San Jose	1,143c	2,381	297	185	3.1
San Leandro	95	849	176	6	6.4
San Mateo	128c	832	253	22	6.1
Santa Ana	138c	1,120	210	114	4.6
Santa Barbara	75	862	192	45	3.4g
Santa Cruz	68	366	85	28	3.7g
Santa Monica	183	1,255	323	127	3.8g
South Gate	131c	831	214	24	3.9g
Stockton	1,907c	1,870	305	108	3.5g
Torrance	172	836	207	14	2.0g
Vallejo	248c	465	109	116	2.9g
Whittier	324	290	80	2	3.4
COLORADO					
Colorado Sp.	606	613	224	72	2.6g
Denver	916	6,031	1,743	638	4.2
Greeley	35c	195	104	10	4.9
Pueblo	259	1,211	218	52	3.4
CONNECTICUT					
Bridgeport	457a	1,961	605	105	3.8
Bristol	114c	426	158	65	4.4
Danbury	76c	255	94	26	4.1g
East Hartford	66c	419	78	18	2.1g
Fairfield	185	608	167	7	3.7g
Greenwich	199	1,232	179	16	4.4
Hamden	315	469	40	22	0.9g
Hartford	622c	2,339	551	220	3.0g
Manchester	81	221	81	14	2.1g
Meriden	457	528	185	32	3.7g
Middletown	28c	230	84	26	2.8
Milford	240	714	73	57	1.7g
New Britain	60c	786	139	86	1.7g
New Haven	512	2,447	724	28	4.4
New London	168a	507	175	48	5.7g
Norwalk	...	724	282	34	5.7
Norwich	99	357	120	17	3.2g
Stamford	213	659	154	39	2.2g
Stratford	400	432	100	4	4.2
Torrington	59a	267	110	12	3.7g
Waterbury	493	1,402	382	110	3.5g
West Hartford	157a	589	70	10	1.2g
W. Haven Twp	...	...	...	...	..
DELAWARE					
Wilmington	729	1,255	756	70	6.6g

a. Estimated. c. Buildings and contents only. d. Insured loss only.

g. Based on 1958 population estimate.

1. Fiscal year ended June 30, 1957. 2. Fiscal year ended September 30, 1957.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
DISTRICT OF COLUMBIA					
Washington	2,410	9,961	2,233	1,114	2.6g
FLORIDA					
Daytona Beach	...	...	...	...	..
Ft. Lauderdale	161c	550	136	28	3.4
Gainesville	178	350	143	20	5.4
Jacksonville	1,062a	3,215	827	260	3.7g
Key West	55	181	20	9	1.0
Lakeland	5,269	491	186	42	4.3g
Miami	853	2,874	751	111	2.3g
Miami Beach	...	...	...	...	..
Orlando	491	975	102	82	1.4g
Panama City	142	421	198	10	6.2g
Pensacola	146	510	167	0	3.9
St. Petersburg	282ac	1,495	358	18	2.1g
Tallahassee	78c	720	133	29	3.0g
Tampa	2,456	3,983	975	326	7.9
W. Palm Beach	134	538	63	27	1.0g
GEORGIA					
Albany	287	862	380	50	8.1g
Athens	...	...	...	...	..
Atlanta	3,125	6,890	2,183	448	6.7
Augusta	643	1,042	483	93	6.8
Columbus	...	...	...	...	..
Decatur	32	312	137	2	6.4
East Point	199	459	140	47	6.5
La Grange	115	356	53	24	2.1g
Macon	376	738	412	107	5.2g
Marietta	83c	422	132	71	6.4
Rome	212	459	209	32	5.2g
Savannah	972	1,546	870	222	6.3g
Valdosta	346	310	163	8	4.7g
IDAHO					
Boise	838c	755	112	37	3.3
Pocatello	38c	380	116	26	3.7g
ILLINOIS					
Alton	253	367	212	8	6.6
Aurora	265	575	...	58	..
Belleville	78c	403	159	4	4.9
Berwyn	80	704	42	14	0.8
Bloomington	242c	1,453	181	24	5.0g
Champaign	95	427	197	20	4.3g
Chicago	...	87,367	21,633	7,270	5.5g
Chicago Hts.	47	533	260	65	9.0g
Cicero	2,218c	1,933	270	50	3.9g
Danville	118	1,059	277	7	4.0g
Decatur	604	1,056	439	33	6.5
East St. Louis	296	1,195	550	138	6.7
Elgin	280c	513	71	14	1.5g
Elmhurst	85	194	84	5	4.0
Evanston	621	766	340	37	4.7
Freeport	61	630	113	18	5.0
Galesburg	993	351	80	15	2.3g
Granite City	...	...	...	...	..
Harvey	315	481	34	12	1.4g
Jacksonville	162	231	63	9	3.1
Joliet	384c	2,177	86	77	1.7g
Kankakee	67	850	72	8	2.9
Maywood	72	429	102	4	3.7
Moline	76	419	140	75	3.8
Oak Park	141	1,069	197	10	3.1
Ottawa	55	351	47	14	2.1
Pekin	606	224	78	3	3.6
Peoria	435	1,704	426	212	3.8g
Quincy	332	454	105	10	2.4g
Rockford	201	1,150	512	40	4.5g
Rock Island	210	693	62	32	1.3g
Springfield	352	1,139	513	33	6.0g
Urbana	30	279	111	14	4.1g
Waukegan	278	1,290	197	42	4.0g
INDIANA					
Anderson	256	767	329	91	6.3g
Bloomington	43	650	197	9	7.0g
East Chicago	731c	2,010	275	102	4.7g
Elkhart	82	552	250	60	7.0
Evansville	664a	1,762	623	119	4.8g
Fort Wayne	542	1,564	941	199	7.1
Gary	432	3,016	675	401	5.1
Hammond	117c	3,319	103	163	0.9g
Indianapolis	1,664	7,788	2,702	290	6.4
Kokomo	89	616	178	66	4.6
Lafayette	351	716	101	51	2.9
Logansport	273	427	129	46	6.2
Marion	...	...	...	...	..
Michigan City	96	604	212	46	6.2g
Mishawaka	64	422	100	55	3.1
Muncie	157	969	788	...	11.6g
New Albany	358	433	218	32	5.7g
Richmond	80c	550	315	58	8.0
South Bend	270	1,909	424	365	3.7
Terre Haute	301	1,429	469	53	7.3
IOWA					
Ames	94	235	123	1	4.1g
Burlington	79	444	84	0	2.3g
Cedar Rapids	163	846	314	49	4.4
Clinton	1,107c	343	155	18	4.4g
Council Bluffs	140	491	168	45	3.4g
Davenport	85	515	84	120	0.9g
Des Moines	1,153	2,450	623	93	3.0g
Dubuque	94	850	310	21	6.3
Fort Dodge	72c	394	66	27	2.3g
Iowa City	37	227	89	1	3.3
Marshalltown	13c	221	98	8	4.5g
Mason City	109	429	95	6	3.3g
Ottumwa	115c	278	123	7	3.2g
Sioux City	155e	1,188	427	43	6.7g
Waterloo	...	...	...	...	..
KANSAS					
Hutchinson	167	570	126	12	3.4g
Kansas City	360	1,373	413	42	3.2

a. Estimated.
c. Buildings and contents only.
e. Subject to change.
g. Based on 1958 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
KANSAS (Continued)					
Lawrence	64	250	140	4	5.6g
Leavenworth	42	302	127	9	5.5g
Salina	35	800	166	6	6.4
Topeka	351	1,446	393	491	5.1
Wichita	521	3,193	637	76	2.5g
KENTUCKY					
Ashland	...	...	...	...	..
Covington	122	878	320	68	5.0
Lexington	73c	2,788	320	95	4.9
Louisville	...	4,293	1,754	468	4.3g
Newport	304c	388	282	49	9.1g
Owensboro	85a	632	311	26	9.4
Paducah	187	812	257	43	5.5g
LOUISIANA					
Alexandria	151c	417	80	77	1.9g
Baton Rouge	457	1,458	445	118	3.6
Lafayette	85	311	140	53	4.2
Lake Charles	...	...	...	...	..
Monroe	234e	900	186	98	3.8g
New Orleans	1,929ac	5,583	1,131	159	1.9g
Shreveport	586	1,299	328	143	2.0g
MAINE					
Auburn	62	456	188	15	8.2
Augusta	205	325	157	8	6.8g
Bangor	36c	599	75	93	2.4
Lewiston	139	661	221	20	5.4
Portland	409	1,481	416	90	4.9g
South Portland	20c	449	138	184	5.5g
MARYLAND					
Baltimore	4,258c	14,031	3,514	1,494	3.5g
Cumberland	...	417	209	72	5.2g
Hagerstown	90	483	283	41	7.9
Montgo'y Cty	989	2,597	957	43	3.0g
MASSACHUSETTS					
Arlington	160c	844	71	54	1.4g
Attleboro	98c	612	56	18	2.2g
Belmont	71c	627	187	23	6.2g
Beverly	42	762	211	27	7.3
Boston	...	17,459	3,594	3,714	4.5
Braintree	74	757	141	45	6.1
Brockton	358	1,749	323	114	4.8g
Brookline	214c	1,339	754	56	13.2
Cambridge	1,111	2,890	1,983	374	16.4
Chelsea	716	1,245	107	106	2.9g
Chicopee	...	...	...	...	..
Everett	313	1,034	162	128	3.6
Fall River	326	1,410	439	93	3.9
Fitchburg	108c	1,681	89	43	2.1g
Framingham	...	...	...	...	..
Gloucester	405a	768	149	33	6.0
Haverhill	259c	1,376	512	154	10.9
Holyoke	165c	951	485	70	8.9
Lawrence	300ce	1,756	266	121	3.3
Leominster	83	1,312	146	15	6.1
Lowell	218c	1,580	397	110	4.1
Lynn	...	2,830	584	265	5.9
Malden	191	1,229	110	49	1.8g
Medford	204	1,662	201	200	3.0
Melrose	223	472	48	44	1.8
Methuen	57	724	98	35	3.6g
Milton	68	660	96	37	3.9g
New Bedford	...	...	...	...	..
Newton	283a	1,767	...	104	..
North Adams	83	382	88	50	4.1
Northampton	...	426	67	60	2.2g
Peabody	126a	523	150	35	6.0g
Pittsfield	95b	816	367	48	6.7g
Quincy	281a	1,948	437	210	5.1g
Revere	244	1,119	52	128	1.4
Salem	200	809	...	72	..
Somerville	608	1,968	364	264	3.6
Springfield	1,056	3,393	706	424	4.2g
Taunton	36	600	166	54	4.2
Waltham	158	1,066	160	55	3.4
Watertown	129c	1,035	100	49	2.6g
Wellesley	91b	535	39	34	1.9
Westfield	39	720	115	6	5.0
W. Springfield	74	374	101	35	5.0
Weymouth	151	905	87	56	1.8g
Woburn	105	1,465	54	66	1.8g
Worcester	1,055a	3,419	1,002	724	4.9g
MICHIGAN					
Ann Arbor	185	657	259	7	4.0g
Battle Creek	363	...	...	...	..
Bay City	200	899	342	20	6.0g
Birmingham	92c	418	...	1	..
Dearborn	278	1,078	228	136	1.6g
Detroit	8,868ac	16,135	5,029	2,818	2.6g
East Detroit	149	343	223	0	5.1g
East Lansing	23	321	33	4	1.6
Ferndale	37	339	115	30	3.6g
Flint	981c	2,163	679	204	4.2
Grand Rapids	660	1,508	261	118	1.4g
Hamtramck	124	645	226	90	5.2
Highland Park	115c	821	237	87	5.2g
Jackson	990c	580	376	69	7.4g
Kalamazoo	316c	973	169	60	2.1g
Lansing	230c	3,101	380	93	4.1
Lincoln Park	74	547	146	25	2.8g
Monroe	23	245	58	...	2.7
Muskegon	86	448	191	61	4.0
Pontiac	444	1,768	396	166	5.0g
Port Huron	154c	633	171	14	4.3g
River Rouge	29	1,067	52	42	2.3g
Royal Oak	239	990	213	126	2.7g
Saginaw	158c	1,451	193	66	1.9g
Wyandotte	227	456	220	55	6.0

a. Estimated. c. Building and contents only. e. Subject to change.
g. Based on 1958 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
MINNESOTA					
Austin	153	212	137	6	6.0
Duluth	473	1,669	577	61	5.6
Minneapolis	2,246	4,753	941	440	1.7g
Rochester	20c	507	226	119	7.7
St. Cloud	164c	336	121	19	4.0g
St. Louis Park	127	615	167	1	4.2g
St. Paul	1,060ae	4,156	1,281	476	3.7g
Winona	241	316	150	15	6.0
MISSISSIPPI					
Biloxi	142	361	115	18	3.1
Greenville	54c	435	209	16	7.0
Gulfport	...	438	63	18	1.9g
Hattiesburg	164	721	129	17	4.4
Jackson	135	1,093	463	80	4.7
Laurel	98	305	157	12	5.2g
Meridian	304c	470	...	32	..
Natchez	157	585	121	13	5.4
Vicksburg	153	456	63	25	1.9g
MISSOURI					
Cape Giradeau	113a	284	44	18	2.0g
Columbia	65c	303	68	18	1.4g
Hannibal	18	175	94	11	4.6
Independence	70	431	186	22	3.1g
Jefferson City	39c	339	64	11	2.1g
Joplin	113	722	258	46	5.2g
Kansas City	1,542a	4,699	2,097	371	4.0g
St. Joseph	...	...	...	...	..
St. Louis	...	...	...	...	..
Sedalia	142	303	134	6	4.8g
Springfield	232a	1,638	418	96	4.0g
University City	106	849	53	14	0.9g
Webster Grove	271c	276	59	4	1.8g
MONTANA					
Billings	...	...	...	...	..
Butte	...	...	...	...	..
Great Falls	80c	625	190	50	4.9
Missoula	...	310	44	22	2.0
NEBRASKA					
Grand Island	100	356	215	...	8.6g
Hastings	40	240	55	4	2.4g
Lincoln	126	1,255	332	28	2.6g
Omaha	830	2,196	967	48	3.2g
NEVADA					
Las Vegas	188c	1,049	178	78	7.3
Reno	272c	1,186	408	48	12.7
NEW HAMPSHIRE					
Concord	97c	494	240	12	8.6g
Manchester	434ac	1,085	245	65	3.0
Nashua	132c	520	204	26	5.1g
NEW JERSEY					
Atlantic City	626	846	390	126	6.3
Bayonne	...	862	162	110	2.1
Belleville	323c	483	110	79	3.4
Bloomfield	46	510	167	42	3.4
Camden	1,688c	1,856	478	226	3.5
Clifton	310	821	128	48	1.5g
East Orange	299bce	1,002	306	57	3.6g
Elizabeth	...	1,200	380	89	3.4
Englewood	...	401	209	47	7.7g
Fair Lawn	47a	212	66	2	2.8
Garfield	39	127	77	2	2.8
Hackensack	474c	502	54	29	1.7g
Hillside	37	293	100	2	4.8
Hoboken	390c	1,121	354	74	7.0
Irvington	445	590	249	17	4.2
Jersey City	986	3,177	1,169	280	3.9
Kearny	131	396	127	27	3.1g
Linden	314	467	197	23	6.5
Long Branch	...	...	...	...	..
Maplewood	185	272	95	14	3.7g
Montclair	712	586	219	22	4.9g
Newark	3,109	6,425	2,859	823	6.5
New Brunsw'k	436c	539	156	42	3.9g
N. Bergen Twp	468	817	90	22	2.0g
Nutley	22	321	57	34	1.9g
Orange	47	606	349	59	9.2g
Passaic	1,491d	744	...	36	..
Paterson	434c	1,943	1,158	171	8.3
Perth Amboy	...	...	...	...	..
Plainfield	...	578	190	32	4.5
Rahway	18	321	90	8	4.1g
Teaneck Twp.	113	771	217	11	5.4g
Trenton	437a	1,403	526	130	4.1
Union City	443c	1,093	223	42	4.0
Union Twp.	265	599	258	6	5.2g
W. New York	328c	682	127	22	3.4
Westfield	...	330	122	10	5.7
West Orange	...	...	...	...	..
NEW MEXICO					
Albuquerque	321	1,277	533	153	2.7g
Roswell	58	286	144	19	3.7g
Santa Fe	...	...	...	...	..
NEW YORK					
Albany	...	...	...	...	..
Amsterdam	37c	246	76	24	2.4
Auburn	58a	303	162	19	4.4
Binghamton	283	805	183	41	2.3
Buffalo	2,410	11,415	1,313	616	2.8
Cohoes	91	460	97	14	4.6
Elmira	132c	451	138	19	2.7g
Endicott	...	...	...	...	..
Freeport	...	...	...	...	..
Gloversville	170c	287	109	13	4.6
Hempstead	500	504	128	33	3.6g
Irondiqu't Twp	...	...	...	...	..
Ithaca	173	110	39	5	1.3
Jamestown	447c	634	150	29	3.5
Kenmore	10	135	79	11	3.6g
Kingston	...	...	...	...	..

a. Estimated. b. Incomplete. c. Building and contents only. d. Insured loss only. e. Subject to change. g. Based on 1958 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
NEW YORK (Continued)					
Lackawanna	230c	566	107	68	3.5g
Lockport	460	503	133	32	5.1g
Middletown	28	244	...	12	..
Mount Vernon	207	1,001	200	57	2.8
Newburgh	74	327	162	26	5.1
New Rochelle	283c	805	383	32	5.1g
New York	...	72,942	24,228	11,931	3.0g
Niagara Falls	252	1,564	326	139	3.2g
N. Tonawanda	43	409	208	13	8.4
Olean	33	281	80	12	3.2g
Oswego	...	...	...	...	..
Port Chester	235	248	33	22	1.4
Poughkeepsie	583	409	212	39	5.2
Rochester	1,385c	3,804	747	306	2.3g
Rockville Ctr.	186	211	106	15	4.8
Rome	137c	497	...	28	..
Schenectady	224	926	262	114	2.7g
Syracuse	1,330	2,031	839	282	4.0g
Troy	172c	1,267	495	31	6.9g
Utica	419c	796	222	46	2.1g
Valley Stream	...	...	...	...	..
Watertown	96c	441	146	35	3.8g
White Plains	113c	928	309	53	5.7g
Yonkers	598a	2,270	643	86	4.2
NORTH CAROLINA					
Asheville	1,293c	766	73	102	1.3g
Burlington	48	603	101	31	3.2g
Charlotte	615	3,099	1,013	582	7.6
Durham	237c	948	529	76	6.0g
Fayetteville	142	804	346	93	10.^
Gastonia	248	244	191	...	4.9g
Goldsboro	232	931	295	27	13.9
Greensboro	279c	1,515	643	149	8.7
High Point	342	777	341	52	8.6
Raleigh	96	1,130	519	159	6.0g
Rocky Mount	149c	441	115	26	3.8g
Wilmington	42	566	301	83	5.5g
Wilson	131c	463	254	55	11.1
Winston-Salem	429	1,767	507	182	5.9
NORTH DAKOTA					
Fargo	290	628	112	16	3.0
Grand Forks	97	318	160	26	4.5g
Minot	26	273	106	10	3.7g
OHIO					
Akron	1,212	2,835	752	362	2.7
Alliance	50	147	...	17	..
Ashtabula	192	338	111	12	4.0g
Barberton	1,125	400	106	65	3.8
Canton	199c	631	259	145	2.2
Chillicothe	26c	576	163	26	5.4g
Cincinnati	930	6,057	2,019	700	3.6g
Cleveland	4,873a	9,870	2,928	1,498	3.2g
Cleveland Hts.	150	1,078	207	18	3.5
Columbus	641b	5,459	2,575	245	5.7g
Cuyahoga Falls	41ac	499	140	34	3.2g
Dayton	776	7,176	739	522	3.0
East Cleveland	121	464	61	22	1.5
East Liverpool	140c	414	126	11	5.0g
Elyria	130	288	157	5	3.9g
Euclid	92	595	223	6	3.4g
Findlay	43c	347	243	15	10.3
Garfield Hgts.	24	222	69	7	2.5g
Hamilton	417	1,758	283	52	3.9g
Lakewood	197	276	90	42	1.3
Lancaster	189	1,245	101	28	4.2
Lima	170	649	338	39	5.9g
Lorain	126	647	113	43	1.8g
Mansfield	...	...	...	...	..
Marion	75	593	103	24	2.7g
Massillon	21	569	119	41	3.4g
Middletown	159	611	204	60	6.1
Newark	127	695	150	24	3.6g
Norwood	22	210	114	16	3.3
Parma	70	463	69	15	2.4
Portsmouth	59	408	155	49	4.2g
Sandusky	443	629	138	22	4.2g
Shaker Heights	293	538	344	18	9.6g
Springfield	58	828	423	78	5.2
Steubenville	221c	408	79	77	2.1g
Toledo	1,743	2,650	952	300	2.8g
Warren	246	560	65	31	1.0g
Youngstown	265	1,670	443	196	2.4g
Zanesville	113c	397	114	81	2.8
OKLAHOMA					
Enid	57c	587	192	20	5.3
Lawton	291	716	247	32	4.1g
Muskogee	71	681	136	31	3.0g
Norman	147	318	140	1	3.6g
Oklahoma City	778	3,705	930	291	3.8
Ponca City	50c	457	152	11	5.9g
Shawnee	34c	363	44	6	1.8
Stillwater	55c	240	105	...	5.3
Tulsa	1,090c	3,657	979	393	3.7g
OREGON					
Eugene	530c	560	350	15	9.8
Portland	1,800ac	4,956	2,442	490	6.1g
Salem	136c	429	269	6	6.3
PENNSYLVANIA					
Aliquippa	...	...	...	...	..
Allentown	121	625	337	62	2.9
Altoona	70	655	203	31	2.6g
Bethlehem	...	408	140	56	1.9
Butler	90	189	50	4	2.1g
Chelt'h'm Twp	206	264	112	...	3.0g
Chester	...	777	...	...	..
Dunmore	...	...	...	...	..
Easton	64c	227	115	27	3.3
Erie	...	...	...	...	..
Harrisburg	200e	601	386	50	4.3
Haverford Twp	195	347	113	8	2.3g
Hazleton	22c	158	64	4	1.8g
Johnstown	37	871	228	61	3.6

a. Estimated. b. Incomplete. c. Buildings and contents only.
g. Based on 1958 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
PENNSYLVANIA (Continued)					
Kingston	15	126	44	13	1.9g
Lancaster	182c	446	298	50	4.6g
Lebanon	147a	152	88	2	2.3g
LowerMerionT	505	887	272	3	4.5g
McKeesport	120	660	148	134	2.7g
Mt. Lebanon T	31	338	98	1	2.8g
Nanticoke	...	...	...	...	..
New Castle	173	498	97	54	2.0
New Kensing'n	...	...	...	...	..
Norristown	...	...	...	...	..
Philadelphia	...	31,066	4,421	3,548	2.1
Pittsburgh	1,362ac	7,958	5,708	972	8.5
Pottstown	399c	144	21	7	0.9
Pottsville	39c	86	34	11	1.4
Reading	347	...	...	...	..
Scranton	1,800c	938	326	119	2.6g
Sharon	264c	319	...	21	..
Uniontown	2,401	206	18	60	0.9g
Upper Darby T	303	518	217	4	1.2
Washington	44	270	125	32	4.5g
Wilkes-Barre	338	568	180	65	3.4g
Wilkinsburg	222a	181	57	70	1.6g
Williamsport	485c	355	102	8	2.3g
York	38c	369	159	53	2.5g
RHODE ISLAND					
Central Falls	29	302	84	16	3.4g
Cranston	255c	3,134	201	90	3.7
E. Providence	241	950	101	68	2.5g
Newport	22	305	162	23	4.3g
Pawtucket	539	1,978	363	129	4.5
Providence	789c	9,256	342	509	1.5g
Warwick Twp.	350	1,872	251	107	4.1g
Woonsocket	254	726	251	96	5.0g
SOUTH CAROLINA					
Charleston	232ac	1,184	564	368	8.3
Columbia	267c	1,368	722	118	6.1g
Greenville	471	1,079	392	144	6.8
Spartanburg	135c	623	179	66	3.6g
SOUTH DAKOTA					
Rapid City	65	...	...	...	..
Sioux Falls	127	604	141	11	2.7
TENNESSEE					
Chattanooga	1,069	2,528	1,295	562	10.0
Jackson	479	320	200	11	5.3g
Johnson City	253	604	179	2	6.5
Knoxville	144c	2,201	706	111	5.4g
Memphis	2,008	6,231	2,373	236	4.8g
Nashville	618	3,081	1,095	414	6.3
TEXAS					
Abilene	466c	1,052	498	80	10.6
Amarillo	1,433c	1,131	175	165	1.3g
Austin	544c	2,216	362	23	2.7
Baytown	157c	220	60	3	2.6
Beaumont	472c	1,392	542	92	5.8
Brownsville	68c	321	...	42	..
Brownwood	41a	2,829	23	967	1.0g
Corpus Christi	180	1,228	603	82	5.6
Dallas	4,267c	9,279	1,837	402	2.7g
Denton	136c	396	94	4	4.5
El Paso	251a	2,494	632	200	4.9
Fort Worth	1,871	5,287	1,480	634	5.4
Galveston	41c	1,156	...	223	..
Harlingen	13c	335	47	13	1.3g
Houston	4,157ac	9,713	3,110	1,591	3.4g
Laredo	254	379	90	37	1.4g
Longview	148	525	127	3	5.2
Lubbock	510a	1,385	312	47	4.4
Marshall	104ac	338	44	12	2.0
McAllen	53c	171	42	5	1.4g
Midland	180c	625	228	16	4.0g
Odessa	179c	725	335	52	3.9g
Orange	95cde	340	89	19	2.6g
Paris	163	436	134	8	5.4g
Pasadena	119	326	115	1	5.2
Port Arthur	380c	646	88	161	1.4g
San Angelo	163c	1,420	710	72	9.5g
San Antonio	1,005	5,579	1,420	348	3.5
Sherman	48c	...	...	...	..
Temple	168a	319	59	30	2.4
Texarkana	...	...	...	...	..
Tyler	207c	750	261	18	4.5g
University Pk.	272c	270	44	2	1.9
Waco	261c	848	375	23	3.4g
Wichita Falls	473ac	1,663	333	161	3.6g
UTAH					
Ogden	395	1,565	214	112	3.2g
Provo City	53	385	74	8	1.8g
Salt Lake City	697	2,856	635	177	2.9g
VERMONT					
Burlington	...	546	242	53	7.3
VIRGINIA					
Alexandria	74c	994	422	118	4.5g
Arlington Cty.	365	1,928	593	31	4.4
Charlottesville	70c	445	151	22	5.8
Danville	196c	518	255	56	7.4
Hampton	347	926	493	20	5.7g
Lynchburg	232e	905	236	96	4.4g
Newport News	...	...	...	...	..
Norfolk	1,293	4,056	993	705	3.4g
Petersburg	151	834	303	65	8.7g
Portsmouth	527a	1,063	358	155	4.0g
Richmond	794	3,592	1,125	376	4.7g
Roanoke	501	1,547	525	243	5.8
WASHINGTON					
Bellingham	171c	685	74	10	2.2
Bremerton	28	352	229	22	7.9g
Everett	215c	656	164	53	4.7g
Longview	51	448	119	34	5.8
Seattle	2,489	5,766	1,056	416	1.8g

a. Estimated. c. Building and contents only. d. Insured loss only. e. Subject to change.
g. Based on 1958 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
WASHINGTON (Continued)					
Spokane	729c	2,459	1,180	193	6.3g
Tacoma	728	2,669	990	161	6.2g
Vancouver	386	425	190	25	6.8
Walla Walla	90c	489	47	46	2.0
Yakima	739	681	287	26	6.4g
WEST VIRGINIA					
Bluefield	103	201	...	16	..
Charleston	369	953	295	207	4.1
Clarksburg	114	192	120	11	3.8g
Fairmont	46c	743	118	2	4.1g
Huntington	990c	1,402	373	177	3.7g
Morgantown	234c	112	56	6	2.2
Parkersburg	177bc	364	105	35	1.8g
Weirton	25	155	32	2	1.0g
Wheeling	118	2,058	184	41	3.2
WISCONSIN					
Appleton	146	624	44	60	1.0g
Beloit	259	...	...	...	..
Eau Claire	50	544	123	4	3.2g
Fond du Lac	130	375	146	32	4.6g
Green Bay	101	1,250	310	75	5.0g
Janesville	40	834	45	29	1.5g
Kenosha	251	1,110	275	28	4.6g
La Crosse	69	828	362	22	7.7
Madison	523e	957	392	63	3.2g
Manitowoc	44	501	153	62	5.1g
Milwaukee	2,505	10,867	1,911	482	2.6g
Oshkosh	343	610	199	30	4.1g
Racine	197	2,170	206	74	2.5g
Sheboygan	366	527	290	27	6.5g
Superior	459	788	276	46	7.9
Waukesha	24	383	114	4	4.1g
Wausau	53	517	317	26	9.1g
Wauwatosa	106	782	153	9	2.7g
West Allis	62	913	142	21	2.2g
WYOMING					
Casper	148	388	123	12	2.9g
Cheyenne	125	470	100	17	2.5g

1958 FIRE LOSSES, CANADIAN CITIES

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
ALBERTA					
Calgary	802	2,058	500	...	2.2g
Edmonton	424	1,890	752	330	3.0g
Lethbridge	89	260	102	19	3.2g
BRITISH COLUMBIA					
Burnaby	215	1,023	131	5	1.4g
New Westmin'r	147	365	83	21	2.3g
Saanich	62	483	95	25	4.0
Vancouver	2,442a	6,072	1,898	216	4.9
Victoria	67	764	351	110	6.4g
MANITOBA					
Brandon	73	330	153	22	5.7g
St. Boniface	28ce	563	...	...	..
Winnipeg	961	3,508	993	769	3.9g
NEW BRUNSWICK					
Moncton	...	...	...	...	..
Saint John	300a	1,485	562	152	8.9
NOVA SCOTIA					
Glace Bay	43c	104	60	6	2.1
Halifax	366	1,805	1,088	122	10.2g
Sydney	...	...	...	...	..
ONTARIO					
Brantford	167	586	312	8	5.9g
Chatham	17c	165	60	4	2.7
East York Twp	50c	396	37	13	0.5g
Etobicoke	260	1,159	489	31	3.9g
Fort William	129c	720	422	4	13.8
Galt	16	370	187	26	8.1
Guelph	135	587	283	0	7.9g
Hamilton	1,041	2,434	517	65	2.6
Kingston	235	742	388	27	10.8
Kitchener	101	524	131	4	3.0
London	633c	1,117	273	65	2.9
Niagara Falls	51c	172	93	16	3.9g
N. York Twp.	342a	1,876	681	25	10.9
Oshawa	427ac	675	69	31	1.3g
Ottawa	953	2,768	1,655	205	6.7g
Peterboro	525	969	572	112	16.3
Port Arthur	137	906	227	109	7.1
St. Catharines	142c	540	366	37	9.7
Sarnia	96c	518	223	10	6.4
Sault Ste. Marie	608ac	530	75	15	2.3
Scarboro Twp.	273c	1,562	843	65	14.1
Sudbury	103c	442	88	48	1.8g
Timmins	103	643	62	29	2.4
Toronto	2,812	7,698	3,039	899	4.6
Windsor	750a	1,395	584	130	4.8g
York Twp.	454	1,156	239	24	2.0g
QUEBEC					
Chicoutimi	...	...	...	...	..
Hull	582	917	541	173	10.8g
Jonquiere	80	350	59	109	2.3
Lachine	86	434	337	48	9.1g
Montreal	7,827e	15,208	2,722	4,564	2.0g
Outremont	106	1,238	...	14	..
Quebec	...	2,423	284	726	1.4
Shaw'gan Falls	189	218	4	27	0.1
Sherbrooke	362c	742	26	120	0.5
Three Rivers	385	474	302	81	5.4g
Verdun	653	898	381	133	4.5g
Westmount	128c	468	154	69	5.3g
SASKATCHEWAN					
Moose Jaw	43	398	35	61	1.4
Regina	337	1,081	518	218	5.2g
Saskatoon	249c	836	424	190	8.0

a. Estimated. b. Incomplete. c. Buildings and contents only. e. Subject to change.
g. Based on 1958 population estimate.

Reviews and Abstracts of Technical Papers

It is NFPA policy to publish in the QUARTERLY significant technical papers which are available dealing with fire subjects. For various reasons many valuable papers cannot be published in full. This department is to review or abstract some papers which otherwise might not be available to readers.

NFPA members are often advised in FIRE NEWS about papers which appear in a publication which can be readily obtained by purchase. Publications listed in FIRE NEWS would not necessarily also be listed in this department.

Members are invited to submit reviews of abstracts of papers which merit mention here. Where possible a copy of the original paper should accompany the review or abstract. Minimum information address of publisher, date, number of pages and price (if one is stated).

Some papers reviewed or abstracted will be from periodicals which are often available only on a subscription basis. In some cases only limited copies of particular papers may be available. The review or abstract, however, may enable members interested to secure copies which will be in the files of various libraries. Most authors would try to furnish copies to other technical people working in the same area, and arrangements can sometimes be made to obtain copies from the source mentioned or on a loan basis. The NFPA library will usually have copies on file but will not be able to lend library file copies.

Raumexplosionen durch Zersetzungsgase-Schwelprodukte oder Schwaden exotherm zerfallender Stoffe (Dust and Vapor Explosions in Buildings). By Prof. Dr. phil. Hermann Selle, Director, Bundesanstalt fur Materialprüfung (Federal Institute for Testing Material), unter den Eichen 86 87, Berlin-Dahlem, Germany. This paper appeared in the quarterly journal of Vereinigung zur Fröderung des Deutschen Brandschutz, e. V. (German Fire Protection Association), VFDB ZEITSCHRIFT, FORSCHUNG UND TECHNIK IM BRANDSCHUTZ, February 1958 issue (Vol. 7, No. 1, page 1). This journal is edited at Karl Wiltberger Strasse 7, Bonn-Lessenich, and published by Verlag W. Kohlhammer, Urbanstrasse 12–14, Stuttgart O, Germany.

The author describes some of the rarer examples of explosions which can occur in spaces in the interior of buildings. Of interest is the following table listing categories of these explosions.

ORIGIN OF EXPLOSIVE MIXTURE FROM COMBUSTIBLE COMPONENTS AND AIR

Purely physical process:
- Mechanical:
  - Mixing of gases
  - Stirring deposits of combustible dusts
  - Spraying combustible liquids not volatile at ordinary temperatures.
- Thermodynamic:
  - Combustible gases or vapors of combustible liquids in their explosive ranges.

Chemical reaction during generation of combustible gases and steam:
- Acids and alkalis on metals
- Water and water solutions on carbides, silicides, phosfides and the like

Biochemical decomposition of organic material (fermentation and rotting)
Chemical heating and smoldering at low temperatures of such materials as wood and coal
Exothermic decomposition of combustible materials

Smouldering Combustion in Dusts and Fibrous Materials. By K. N. Palmer of the staff of the Fire Research Station of the Joint Fire Research Organization of the British Department of Scientific and Industrial Research and the British Fire Offices' Committee. It is published in Combustion and Flame, quarterly journal of the Combustion Institute, June, 1957, published by Butterworths Publications, Ltd., 88 Kingsway, London, W. C. 2, England (Volume I, No. 2, page 129).

The paper reports experiments with small trains of dust, with ignition below the surface of a heap of dust and with the smoldering of a rigid porous combustible board. Dusts used in the experiments with small trains were cork dusts, beech and deal sawdusts and grass dust. The composition of the combustible fiberboard strips is not specifically identified.

Smoldering rates of several types of dust and of a rigid combustible board were measured under various conditions. The temperatures of the smoldering zone and the minimum depth of dust deposit required for sustained smoldering were determined. The propagation of smoldering inside dust deposits, following ignition at or near the base of the deposits, was studied with several dusts in layers. Sustained smoldering could be obtained inside deposits of dusts up to 85 centimeters deep and no indication was found that the depth could be so increased that smoldering would not be sustained.

The experiments with dusts formed into trains and with strips of a combustible board showed that the smoldering rates were low in still air and were markedly increased by an applied air flow. This simple approximate relation between the air velocity and the smoldering rate of dusts is generally understood, but the experiments showed that it broke down when coarser dusts were involved. If the dust was sufficiently coarse, flaming could develop from the smoldering.

Flammability of Thin Flexible Materials. By C. T. Webster of the staff of the Fire Research Station of the Joint Fire Research Organization of the British Department of Scientific and Industrial Research and the British Fire Offices' Committee. This article is published in the Journal of the British Textile Institute, 10 Blackfriars Street, Manchester, England (1957, Volume 48, page T-471).

A flammability test for thin flexible materials is described in British Standard No. 476, Part II, 1955. The present paper supplements an earlier one by D. I. Lawson, C. T. Webster and M. J. Gregsten of the British Fire Research Station staff which was published in the Journal of the British Textile Institute (1955, Volume 46, page T-453). That article described the apparatus on which the British standard test is based. It consists of a semicircular arched track around which the fabric to be tested is placed for measuring the flammability. In the earlier paper, two expressions were derived empirically for the vertical flamespread V. One of these expressions related to materials which would propagate flame completely around the semicircle in which case the time of burning T was noted. The vertical flame speed was then given by:

$$V = 650/T^{1.03}$$

Where V is in inches per second and T is in seconds.

If, in the material tested, the flame was not propagated completely around the semicircle but went out at a distance (d) measured in inches around the circumference, another expression for V was derived.

$$V = 0.71\ d^{0.4}$$

This paper describes some of the difficulties obtained in getting representative readings. For example, for some wools and the Japanese silks, the predicted vertical flame speed appears to be too large. This is not a feature of short distances of spread, for it also occurs with acetate fabrics which spread the entire 21 inches around the arc of the apparatus. This is considered to be due to the dripping which is characteristic of these materials when burning vertically but is absent when they burn supported in a test apparatus.

As a result of the last group of tests, it is suggested that flammability of fabrics be referred to in terms of the time taken for the flame to travel a given distance in the vertical direction, and a Figure of Merit (M), has been defined as the time in seconds for the flame to travel 100 inches calculated from the expression:

$$V = 0.31\ d^{2.5}/T$$

This gives a Figure of Merit which is:

$$M = 320\ T/d^{2.5}$$

Extinction of Fires in Liquids by Cooling with Water Sprays. By D. J. Rasbash and Z. W. Rogowski of the Fire Research Station of the Joint Fire Research Organization of the British Department of Scientific Industrial Research and the British Fire Offices' Committee. This paper was published in Combustion and Flame, the quarterly journal of the Combustion Institute, December, 1957, published by Butterworths Publications, Ltd., 88 Kingsway, London, W. C. 2, England (Volume I, No. 4, page 453).

The paper describes a series of investigations which were conducted at the British Fire Research Station. The authors report that extinctions which occurred when liquids burning in open vessels were cooled by water sprays projected downwards onto the liquid surface have been correlated in one equation relating the extinction time with the spray and the fire properties.

The experimenters found that the extinction time was directly proportional to the drop size of the spray and the preburn time and inversely proportional to the rate of flow of water per unit of fire area and also to the difference in temperature between the fire point and ambient temperature raised to the power 1.75. The equation does not cover conditions in which splash fires were developed.

It is inferred that, in the tests on which the equation is based, cooling took place as a result of heat transfer between the oil and the water drops.

Progress Review No. 38: A Review of Information on Selected Aspects of Gas and Vapour Explosions. By K. N. Palmer, Scientific Officer of the Chemistry and Chemical Engineering Section of the British Joint Fire Research Organization, published in the Journal of the British Institute of Fuel, 18 Devonshire Street, Portland Place, London, W1, July, 1956, issue (Volume 29, No. 186, pages 293–301 price, 10 shillings).

The British Joint Fire Research Organization is sponsored by a government agency, the Department of Scientific and Industrial Research, and by a private organization, the Fire Offices' Committee of the British fire insurance companies. The activities of the joint organization are under the direction of a Fire Research Board, and a Fire Research Station is located in Boreham Wood, Hertfordshire, England.

In 1955 the Board created a separate Committee on Industrial Fires and Explosions. This Committee was set up to be helpful to inspectors of the British Factory Department. The work of this Committee is described in the report of the Fire Research Board and the report of the Director of Fire Research, entitled "Fire Research, 1956" (74 pages, available from H. M. Stationery Office for 4 shillings; in the United States it may be ordered from British Information Services, 45 Rockefeller Plaza, New York 20, New York, for 72 cents). The Committee was established to consider the industrial hazards which arise from the flammability of certain dusts,

vapors and gases and to advise the Director of Fire Research on investigations that would enable industry to avoid or reduce the effects of these hazards. Experimental work for the Committee is carried out both at the Fire Research Station at Boreham Wood and at the British Safety in Mines Research Establishment at Buxton. Mr. Palmer's paper, Progress Review No. 38, was prepared at the request of and for the information of this Committee.

Technical papers bearing on the problem make up a part of the paper, grouped under the following headings: (1) flame propagation, (2) combustion in long pipe lines and detonation; (3) venting; and (4) flame quenching. Apparently the author did not have access to indexes of NFPA publications which record the work of NFPA committees concerning this problem and which list accounts of explosions which have been published. Generous reference was made in the paper, however, to the NFPA Guide for Explosion Venting (NFPA No. 68 published in pamphlet form and in the National Fire Codes, Volume II).

The author is apparently a combustion scientist rather than a fire protection engineer for he took the trouble to explain that the combustion processes involved in internal combustion engines were not directly considered for this review. The project which he is reporting, he explains, relates particularly to the hazards of mixtures of combustible gas or vapor with air or oxygen in confined spaces (such as pipes, ducts and other enclosed plants) and concerns chiefly "premixed" flames rather than "diffusion" flames.

The field covered in this review was also restricted to the velocity of propagation of combustion, the rates of rise in pressure, the maximum pressures obtained, the venting areas desirable and like matters. The review concentrates on these aspects to the exclusion of others such as the ignition phenomena (except where related to flame quenching); flammability limits; and (to a large extent) the chemistry of flame reactions.

This paper is a valuable contribution as it brings together in one place information on the four general categories which were mentioned in the groupings of the reference material. It notes that there is a frequent lack of correlation between points of extreme practical interest, such as the venting requirements and the burning velocity of the explosive mixture with the geometry of the containing systems. The various experimental methods of measuring the burning velocities of gases and vapors are described in the paper in detail while noting the considerable variation in the published values for the burning velocities of many of the common gases. In the latter connection, emphasis is given to the fact that only in a few cases have the burning velocities been measured under identical conditions.

Index to Volume 52—Quarterly of the NFPA

NOTE: References are to Volume Number and Page. The page numbers in the various issues are as follows:

Pages 1–80: July 1958
Pages 81–144: October, 1958
Pages 145–226: January 1959
Pages 227–390: April 1959

A

Abstracts, Reviews of Technical Papers. Q52:77, 143, 374
Acetate Fabrics, Measuring Flammability of. Q 52: 376
Acetate Fabrics, Use in Clothing, Burning Characteristics of. Q52:120
Acetylene Cylinders Rupture. Q52:243
Acoustical Tile. *See also Fiberboard, Paperboard*
Fire Tests of. Q52:215
Fires Spread by. Q52:277
ACTION Program in Depressed Areas. Q52:52
Advertisers Index. Q52:80, 144, 226, 390
Air Conditioning Equipment. *See Ducts*
Aircraft Carriers, Protection for. Q52:17
Aircraft Fire Detection Should Come of Age. By Harvey L. Hansberry. Q52:179
Aircraft Fires, Large Loss:
Bohemia, N. Y., Jan. 9, 1958. Q52:325
Ellsworth AFB, S. D., Feb. 11, 1958. Q52:326
El Toro, Calif., Nov. 19, 1958. Q52:329
McChord AFB, Wash., June 13, 1958. Q52:331
McClellan AFB, Calif., Mar. 22, 1958. Q52:330
McConnell AFB, Kansas, Aug. 14, 1958. Q52:334
Melbourne, Fla., Mar. 17, 1958. Q52:327
Miami, Fla., Mar. 25, 1958. Q52:330
Nantucket Airport, Mass., Aug. 15, 1958. Q52:329
Newark, N. J., May 2, 1958. Q52:328
New Haven, Conn., Mar. 1, 1958. Q52:332
Palm Springs, Calif., Feb. 13, 1958. Q52:326
Quonset, R. I., Jan. 27, 1958. Q52:332
Truax Field, Wisc., Mar. 7, 1958. Q52:333
Westover AFB, Mass., June 27, 1958. Q52:328
Aircraft Hangars. *See Hangars*
Aircraft Plant Fires, Large Loss:
Santa Monica, Calif., Feb. 17, 1958. Q52:263
Aircraft Tanks, Explosion Suppression Systems for. Q52:78, 109
Alarm. *See also Detection*
Alarm Box:
Lack of Delayed Alarm. Q52:169, 174
Used Effectively. Q52:237, 239, 251, 253, 256, 259, 265, 270, 280, 288
Alarm Systems:
Central Station, Fires in Properties Protected by. Q52:73, 249, 255, 257, 291, 293, 294, 309
Effective. Q52:175
Ineffective. Q52:258
Lacking. Q52:174
Local in Buildings, Fires in Properties Protected by. Q52:73, 160, 169, 174, 175
School Requirements for. Q52:177
Alarms, Building, Number by Cities. Q52:367
Alarms Delayed:
Observers Did Not Call Fire Dept. Q52:257
Occupants Fought Fire. Q52:73, 237, 241, 242, 261, 281, 294, 317
Occupants Investigate Gas Odor. Q52:282
Occupants Investigate Smoke. Q52:260, 277
Phone Reached Wrong Fire Dept. Q52:262
Phone Wires Burned. Q52:239, 244, 256, 261, 262
Smoke Prevented Access to Phone. Q52:262
Alarms, False, Number by Cities. Q52:367
Alarms, Simultaneous. *See Public Protection*
Alumina, Activated, Use on Aluminum Alkyl Fires. Q52:144
Aluminum Alkyls. Q52:143
Aluminum Casting. *See Metalworking*
Aluminum Chloride, Use as Fire Extinguishing Medium. Q52:144
Aluminum Domes, Geodesic. Q52:104, 151
Aluminum Fabrication. *See Metalworking*
Aluminum Refining. *See Metalworking*
Aluminum, Unprotected, Damaged by Fire. Q52:280
American Petroleum Institute. Q52:78, 79
Analog Computers, Fire Test Method. Q52:219
Ansul Chemical Company, Fire Research by. Q52:143
Apartment Building Fires, Large Loss:
International Falls, Minn., Mar. 7, 1958. Q52:238
Logan, O., Feb. 18, 1958. Q52:260
Apparatus, Fire, Maintenance of. Q52:130
Architects' Responsibility for Large Loss Fires. Q52:335
Arson. *See Incendiary*
Art Museum. *See Museum*
Asbestos Board, Failed During Fire. Q52:91
Asphalt, Built-up Roof:
Fires Involving. Q52:258
Fire Tests of. Q52:191
Asphalt-Coated Metal, Fire Spread on. Q52:241, 244, 294
Atlantic Research Corporation, Fire Research by. Q52:144
Atomic Bombs, Fire Effects of. Q52:61
Atomic Energy Commission. *See U. S.*
Attic and Roof Spaces, Undivided. Q52:45–52, 243, 248, 260, 265, 270, 281, 289, 293
Automatic Fire Detection. *See Detection*
Auto Sales Rooms, Large Loss Fire:
Harvey, Ill., Jan. 9, 1958. Q52:288
Automatic Sprinklers. *See Sprinklers*
Awnings, Fires Spread by. Q52:305

B

Babcock, Chester I. Q52:155
Bakeries. *See Food Products*
Banks. *See Office Buildings*
Basement, No Access for Fire Fighting. Q52:316, 317
Basement Sprinklers — Retroactively. By Dale F. Gilman. Q52:6
Batie, R. V. Q52:202
Beech Dust, Research on. Q52:375
Board of Directors Meetings, NFPA. Q52:12, 13, 231

Boat Yards. *See Marinas*
Bogota, Colombia, Department Store Fire. Q52:148 (Frontispiece), 151
Bomb Test, Nevada, Fire Effects. Q52:53
Bond, Horatio. Q52:64, 193
Boston's Blighted Boroughs. By Benjamin M. Hermes. Q52:45
Brick, Tile and Pottery Works, Large Loss Fires:
Compton, Calif., Dec. 7, 1958. Q52:245
Newcomerstown, O., May 9, 1958. Q52:311
St. Louis, Mo., Sept. 15, 1958. Q52:259
Brigades, Industrial:
Lack of. Q52:241
Satisfactory. Q52:263, 299, 303, 306, 320.
Unsatisfactory. Q52:299
British Joint Fire Research Organization. Q52: 375, 376
British Textile Institute, Journal of. Q52:375
Brush Fires. Q52:149
Bugbee, Percy. Q52:5, 152
Building Code Criticisms Often Misdirected. By Horatio Bond. Q52:64
Building Code Requirements:
Dwellings. Q52:193–201
Fire Test References in. Q52:219
Geodesic Domes. Q52:108
Building Exits Code. Q52:76, 152, 169–178.
Building Materials, Combustible: *See also Fiberboard, Hardboard, Interior Finish, Paperboard, Plywood*
Fire Spread by. G52:168, 194, 225
Fire Tests of. Q52:64–66, 182–192, 204–220
Building Materials Storage. *See Warehouses*
Buildings. *See also Construction*
Dilapidated, Removal of. Q52:45
Fire-Resistive, Large Fires in. Q52:67, 243, 259, 276, 282, 284, 292, 299, 303, 308
Buildings Under Construction, Large Loss Fires:
Oshkosh, Wisc., May 13, 1958. Q52:243
Sherbrooke, P. Q., Dec. 15, 1958. Q52:284
Bureau of Explosives, Permits for Shipping Radioactive Materials. Q52:203
Burglar Alarm, Shorting of Transmits Fire Alarm: Q52:240, 243, 259, 305
Burning Characteristics of Fabric Clothing. By Joe R. Yockers. Q52:120
Butane Tank Explosion. Q52:320

C

California Conflagration Hazards. Q52:149
Calorimeter, FM Construction Materials. By Norman J. Thompson and E. H. Cousins
Canneries. *See Food Products*
Carbon Dioxide:
Use on Aircraft Fires. Q52:325, 326, 330, 332
Use on Aluminum Alkyl. Fires. Q52:143
Use on Flammable Liquid Tanks. Q52:79
Carbon Dioxide System, Damaged by Explosion. Q52:306
Carbon Tetrachloride, Use on Aluminum Alkyl Fires. Q52:143
Casualties. *See Exits and Fatalities*
Causes, Fire. *See also Specific Cause*
Building Fires, Large Loss. Q52:237
Number of Fires in U. S. by, Q52:135
Ceilings. *See also Fiberboard, Plywood, Wall and Ceiling*
Fire-Resistant, Pierced by Electrical Recessed Fixtures. Q52:241
Chemical Plant Fires, Large Loss:
Geismar, La., Nov. 25, 1958. Q52:296
Kalamazoo, Mich., Jan. 15, 1958. Q52:306
Chemical Warefare Service, Filters for Radioactive Dust. Q52:39
Chicago Municipal Code. Q52:170
Chicago School Fire. By Chester I. Babcock and Rexford Wilson. Q52:155
Children, Amateur Rockets Hazard to. Q52:100
Children Playing With Matches, Fire Caused by. Q52:321
Chimneys, Safe Installation in Dwellings. Q52:200
Chlorobromomethane:
Use on Aircraft Fires. Q52:326, 334
Use on Aluminum Alkyl Fires. Q52:143
Use with Explosion Suppression System. Q52:78
Church Fire, Large Loss:
Union, S. C., Jan. 8, 1958. Q52:240
Cigarettes. *See Smoking and Matches*
Cities, Fire Record of 1958. Q52:366
Civil Defense Administration, Federal. *See U. S.*
Classifying Hazards of Materials. Q52:62
Clothing, Dry Goods Stores. *See Stores*
Clothing, Fabric, Burning Characteristics of Q52:120. *See also Fabrics*
Clubs, City, Large Loss Fires:
Eugene, Ore., Dec. 11, 1958. Q52:262, 316
Jackson, Mich., Feb. 16, 1958. Q52:313
Clubs, Country, Large Loss Fires
Flint, Mich., Jan. 8, 1958. Q52:304
Clubs, Night, Large Loss Fires
Dayton, Ohio, Jan. 29, 1958. Q52:291
Coal Furnace. *See also Heating*
Overheated, Fire Caused by. Q52:240
Coal Mine Methane Indicators. Q52:358
Coating, Fire Retardant for Lumber. *See Lumber*
Cold Storage Warehouses. *See Warehouse Fires*
Colleges and Universities, Large Loss Fire:
Loretto, Pa., Jan. 23, 1958. Q52:258
Columbia University, Fire Test Work. Q52:215
Combustibles, Fire Load Factor. Q52:28–37. *See also separately listed combustibles*
Combustion and Flame Journal. Q52:375, 376
Combustion Institute. *See Combustion and Flame*
Communications, Fire Department. Q52:129
Concealed Space Under Floor, Factor in Fire Spread. Q52:295
Concealed Spaces. *See Wall and Ceiling Concealed Spaces*
Conflagration Warning, California. Q52:149
Conflagrations, Research on. Q52:221
Construction. *See also Buildings and Specifically Listed Construction Defects*
Combustible, Factor in Exposure Fires. Q52:45–52, 244, 265, 270, 280, 286, 287, 288, 295, 316
Combustible, Hazard to Occupancy. Q52:28–37, 45–52, 68, 69, 155–175, 194
Combustible, Radiation Ignition Hazards. Q52:53–61
Domes, Geodesic. Q52:104–108, 151
Containers, for Radioactive Material. Q52:207
Contents, Factors, Influencing Fire Spread in Large Loss Fires. Q52:341. *See also separately listed materials*
Conveyor Openings, Fires Spread Through. Q52: 269, 270, 296, 302
Cooking. *See Heating and Cooking*
Cork Dust, Research on. Q52:375
Corrosion, Factor in Fire Cause. Q52:319
Corrosion of Metals by Foam Concentrates. Q52: 143
Costumes. *See Clothing*
Cotton, Burning Characteristics of Clothing. Q52: 120. *See also Fabrics*
Cotton Storage. *See Warehouse Fires*
Cousins, E. W. Q52:186
Crash Fires, Aircraft. *See Aircraft*
Creosoted Wood:
Bomb Fire Tests. Q52:56
Involved in Fire. Q52:293
Curtains, Flameproofed, Fire Tests for. Q52:209
Cutting Torches. *See Torches, Cutting*
Cyclones, Explosion Protection for. Q52:109–119

D

Dacron, Burning Characteristics of Clothing. Q52:120

Davis Emergency Equipment Co., Combustible Gas Indicators. Q52:360, 361

Deal Dust, Research on. Q52:375

Degreaser, Fire Caused by. Q52:262

Delayed Alarms. *See Alarms, Delayed*

Delayed Detection. *See Detection, Delayed*

Department Stores. *See Stores, Department*

Department of Scientific and Industrial Research (United Kingdom). *See British Joint Fire Research Organization*

Detection, Delayed, Factor in Fire Experience. Q52:73, 155–170, 239, 240, 242, 243, 245, 246, 247, 248, 250, 251, 255, 259, 260, 262, 264, 268, 270, 272, 273, 277, 280, 288, 289, 291, 298, 302, 304, 309, 311, 313, 314, 316

Detection Systems, Fire:
- Aircraft Powerplant. Q52:179
- Explosion Suppression. Q52:109–119
- Hotels, Use in. Q52:28–37

Detection Systems, Smoke, Need for Illustrated by Fire. Q52:76

Detectors, Visual Type, Research on. Q52:77, 113

Dibromodifluoromethane, Use in Explosion Suppression Systems. Q52:78

Dikes, for Flammable Liquid Tanks, Factor in Fire Experience. Q52:85–98

Dilapidated Buildings. *See Buildings, Dilapidated*

Dip Tanks, Fire Involving. Q52:280, 294

Doors, Fire: *See also Openings*
- Effective. Q52:170, 175, 250, 255, 261, 289, 296
- Hotels. Q52:37
- Lacking, Factor in Fire. Q52:196, 198, 286
- Open During Fire. Q52:268, 270, 293, 317
- Substandard, Factor in Fire. Q52:69, 72, 167, 270
- Tests for. Q52:219

Doors in Dwellings. Q52:197–200

Draft Stops, Lack of, Influence on Fire Spread. Q52:253, 275, 297

Drainage Ditches, Factor in Spread of Flammable Liquid Fires. Q52:85–98

Drapes:
- Fire Spread by. Q52:262
- Flameproofed, Fire Tests for. Q52:209

Dresses. *See Clothing and Stores, Clothing*

Drier, Paint, Factor in Fire. Q52:294

Drills Exit. Q52:175, 177

Drugs Storage. *See Warehouses*

Dry Chemical:
- Use on Aircraft Fire. Q52:328
- Use on Aluminum Alkyl Fires. Q52:143

Dry Cleaning. *See Laundries*

Dryers, Powder, Explosion Suppression Protection for. Q52:116

Ducts:
- Exhaust Systems, Factor in Fire. Q52:294
- Heating and Ventilating, Factor in Fire. Q52:73, 277

Dumb Waiter Shafts. *See Openings*

Dust:
- Explosion, Fire Caused by. Q52:284
- Explosion Research in Buildings. Q52:374
- Explosion Suppression Systems. Q52:109–119
- On Structural Members, Spread Fires. Q52:285, 290, 298, 300, 302, 309
- Radioactive, Filters for. Q52:39

Smouldering Combustion, Research on. Q52:375

Dwellings:
- Construction Safeguards. Q52:193–201
- Depressed Areas. Q52:45–52
- Inspections of. Q52:126

E

Editorials:
- California Conflagrations. Q52:149
- Fire Research. Q52:150
- It Can Happen Here. Q52:151
- Legal Compulsion or Moral Suasion. Q52:151
- Tribute to Dick Vernor. Q52:5

Educators, Responsibility for Large Loss Fires. Q52:336

Electrical Equipment Plant Fires. *See Metalworking*

Electrical Equipment Storage. *See Warehouses*

Electrical Fires: *See also Causes, Fire; Light Bulbs; Light Fixtures*
- Appliances, Fires Caused by. Q52:243, 271, 302
- Cause of Large Loss Fires. Q52:237, 313
- Explosion Proof Equipment Needed, Not Available. Q52:263
- Motors, Fires Caused by. Q52:243, 294
- Wiring, Fires Caused by. Q52:237, 238, 262, 271, 273, 275, 316

Electrical Generating Plant Fires, Large Loss:
- Center Twp., Ohio, July 22, 1958. Q52:320
- Port Washington, Wisc., Jan. 31, 1958. Q52:292

Electrical Power Lines Damaged by Fire. Q52:320

Electricity, Static. *See Static*

Electronics Corporation of America, Fire Research by. Q52:77, 78

Electrostatic Hazards. *See Static Electricity*

Elevator, Grain, Explosion Suppression Equipment for. Q52:115

Elevator Shafts. *See Openings*

Elevators, Used During Fires. Q52:73

Emmons, Howard W. Q52:221

Engines, Aircraft, Fire Detection Systems for. Q52:179

Escapes, Fire, Outside:
- Hotels. Q52:27–38
- Used in Evacuating. Q52:161

Esso Research and Engineering Co., Fire Research by. Q52:78, 79

Ethylene Oxide, Fires Involving. Q52:296

Evacuation, Effective. Q52:73

Exhaust Systems:
- Filtering Radioactive Dust. Q52:39
- Involved in Fire. Q52:294

Exit Drills. *See Drills, Exit*

Exits: *See also Escapes, Fire, Outside; Evacuation*
- Blocked by Smoke. Q52:73, 155–170
- Dwellings, Requirements for. Q52:196
- Hotels in Winnipeg. Q52:27–38
- Inadequate, Cause of Casualties. Q52:148
- Inadequate, Threat to Life Safety. Q52:28–37, 67–77, 155–170, 196.
- School Requirements. Q52:176
- Signs for. Q52:27–38

Explosion:
- Research on Dust and Vapor Explosions in Buildings. Q52:374
- Suppression Systems. Q52:77, 78, 109–119
- Venting. Q52:109–119

Explosion Proof Combustible Gas Indicators. Q52:362

Explosion Proof Electrical Equipment. *See Electrical Fires*

Explosion Protection Operating Experience. By George J. Grabowski. Q52:109

Explosions:
- Amyl Nitrate Tank. Q52:94
- Diesel Oil Tank. Q52:94
- Fatal. Q52:245, 248, 282, 283, 284, 299, 311, 324
- Fire Gases. Q52:317
- Fireworks. Q52:245
- Flammable Liquids. Q52:85–98, 244, 265, 280, 296, 323
- Gas Main. Q52:311

Gas Well. Q52:248
Magnesium. Q52:249
Nitromethane. Q52:324
Exposure Fires. *See Construction, Combustible; Sprinklers, Exposure Protection; Walls; Windows*
Exposure, Fires Caused by. Q52:48–50; 53–61
Extinguishers:
Insufficient Capacity or Number at Fire. Q52:73, 276, 278, 295, 298, 304
Satisfactory Performance. Q52:277, 292, 306
Trucks Handling Radioactive Material. Q52:208
Wrong Kind Used. Q52:241, 242, 261, 297, 299, 300, 303, 305
Extinguishment, Mechanism of Flame by Aluminum Chloride. Q52:144

F

Fabrics, Flameproofed:
Bomb Fire Tests. Q52:57
Fire Test Methods. Q52:209
Fabrics, Measuring Flammability of. G52:375
Factory Mutual Laboratories. Q52:186, 219
Fatalities:
Aircraft Fire Accidents. Q52:326, 328, 329, 330, 332, 334
Explosions, Cause of. Q52:245, 248, 282, 283, 284, 299, 311, 324
Rockets, Amateur, Cause of. Q52:100
Smoke, Cause of. Q52:74, 155–178, 200, 276
Trapped by Burning Oil. Q52:85
Trapped by Fire. Q52:148, 150, 155–178, 194, 196, 198, 200, 256, 322, 323
Federal Civil Defense Administration. *See U. S.*
Federal Flammable Fabrics Act. Q52:123
Feed Mills. *See Food Products*
Fencing, Handicap to Fire Fighting. Q52:248
Fertilizer Plant Fire, Large Loss:
Norwalk, Conn., Mar. 13, 1958. Q52:260
Fiberboard, Combustible:
Fire Spread by. Q52:168, 173, 240, 274, 275, 277, 289, 302, 305
Fire Tests of. Q52:190, 191, 212, 217, 375
Fibers, Burning Characteristics in Clothing. Q52:120
Filter Manufacturing Plant Fire, Large Loss:
Louisville, Ky. Feb. 3, 1958. Q52:268
Filters, Radioactive, Design Fire Problems. Q52:39
Finish, Interior. *See Fiberboard, Hardboard, Interior Finish, Paperboard, Plywood*
Fire Apparatus. *See Apparatus*
Fire Boat, Used at Fire. Q52:237, 285, 293, 323
Fire Department. *See Protection, Public*
Fire Detection System. *See Detection*
Fire Doors. *See Doors*
Fire Drills. *See Drills, Exit*
Fire Escapes. *See Escapes, Fire*
Fire Extinguishers. *See Extinguishers*
Fire Fighting Handicaps. *See Basements; Doors; Explosions; Fencing; Partitions; Smoke; Snow; Walls, Blank; Water Supplies; Weather; Wind; Windows*
Fire Fighting, Organization for in Fire Departments. Q52:127
Fire Fighting. *See Protection, Public and separately listed methods*
Fire Offices' Committee. *See British Joint Fire Research Organization*
Fire Prevention. *See Prevention, Fire and separately listed methods*
Fire Protection Developments in 1958. By Percy Bugbee. Q52:152
Fire Protection. *See Protection, Private Protection, Public and separately listed methods*
Fire Pumps. *See Pumps*
Fire Record by Cities, 1958. Q52:366
Fire Research, U. S. Program. By Howard W. Emmons. Q52:221
Fire Retardant Treated Lumber. *See Lumber*
Fire Tests and Fire Protection Engineering. By A. J. Steiner. Q52:209
Fire Walls. *See Walls*
Fireplace, Fire Caused by. Q52:200
Fireproofing. *See Flameproofing*
Fires and Fire Losses Classified, 1957. Q52:135
Firestopping. *See Wall and Ceiling Concealed Space*
Fireworks Storage. *See Warehouse Fires*
Five Cent to a Dollar Stores. *See Stores*
Flame Arrestors for Combustible Gas Indicators. Q52:361
Flameproofing:
Curtains, Fire Showing Need for. Q52:76
Fabrics. Q52:57, 123, 209
Wood, Fire Tests for. Q52:214
Flammability, Identifying Hazard of Materials. Q52:62
Flammable Liquids:
Anti-Static Additives. Q52:78, 143
Cleaning With, Fires Caused by. Q52:244, 263
Combustible Gas Indicators for Measuring Concentrations of Vapors. Q52:357
Fires Caused by or Involving. Q52:85–98, 238, 239, 243, 244, 250, 263, 280, 281, 286, 303, 306, 320, 324, 325–334
Pumping Rate, Influence on Static Hazard. Q52:79
Static Electrical Hazard. Q52:78, 79, 113
Tanks, Explosion Suppression Equipment for. Q52:109–119
Water Spray Cooling of Tank Fires Involving, Research on. Q52:376
Floors and Walls, Oil-soaked. Q52:253
Floors, Shrinkage of Green Lumber Caused Gaps Spreading Fire. Q52:259. *See also Walls and Ceilings, Concealed Spaces*
Flour Mills. *See Food Products*
Flues, Safe Installation in Dwellings. Q52:200. *See also Vents*
F. M. Construction Materials Calorimeter. By Norman J. Thompson and E. W. Cousins. Q52:186
Foam:
Use on Aluminum Alkyl Fires. Q52:143
Used During Fires. Q52:95, 320, 325, 326, 328, 330, 332–334
Foam Concentrates, Corrosive Effects on Metals. Q52:143
Foam Rubber, Fires Involving. Q52:278
Foam-Water Sprinklers, Research Tests. Q52:17
Food and Grocery Storage. *See Warehouse Fires*
Food Products (Canneries) Plant Fire, Large Loss:
East Gwillimbury Twp., Ont., Dec. 18, 1958. Q52:240
Food Products (Flour & Feed Mills) Plant Fires, Large Loss:
Albany, N. Y., Mar. 3, 1958. Q52:284
Colton, Calif., Oct. 2, 1958. Q52:269
Franklin, Tenn., Jan. 8, 1958. Q52:301, 302
Huntington, W. Va., Jan. 9, 1958. Q52:300
Food Products (Fruit Packing) Fire, Large Loss:
Duarte, Calif., June 26, 1958. Q52:238
Forest Fires, Large Loss:
Cleveland National Forest, Calif., Dec. 17, 1958. Q52:322
Malibu Beach, Calif., Dec. 2, 1958. Q52:322
Monrovia, Calif., Oct. 3, 1958. Q52:321
Northwestern Alberta, Aug. 2, 1958. Q52:321
Forest Fires, Research on. Q52:221
Forest Products Laboratory. Q52:214, 217
Foundries. *See Metalworking*
Fowler, Everett W. Q52:193
Fraternity House Fire, Washington, D. C. Q52:150
Friction Heat, Ignited Belt. Q52:300
Friction Spark, Fire Caused by. Q52:319
Fruit Packing Plants. *See Food Products*

Fuel Tanks, Explosion Suppression Equipment for. Q52:78. *See also Flammable Liquids*
Furnace Rooms, Fire-resistive, Enclosures for. Q52:37, 176
Furnace Rooms, Not Cut off. Q52:240, 276, 277, 286
Furniture Manufacturing. *See Woodworking Plants*
Furniture Storage. *See Warehouses*
Furniture Stores. *See Stores, Furniture*

G

Gamma Radiation Problems. Q52:202
Garage Fire, Large Loss:
Birmingham, Ala., Apr. 19, 1958. Q52:281
Gas: *See also Torches, Cutting and Welding*
Appliances, Fires Caused by. Q52:240, 262, 284, 305
Combustible Indicators for Measuring Concentrations. Q52:357
Cylinders, Exploded During Fire. Q52:283
Liquefied Petroleum Involved in Fires. Q52:320, 324
Piping, Failures Cause Explosions. Q52:211, 282, 283, 320
Torch, Fire Caused by. Q52:274, 275
Vents. *See Vents, Gas*
Gas Manufacturing Plant Fire, Large Loss:
Texas City, Texas, Mar. 20, 1958. Q52:299
Gas Transmission Line Fire, Large Loss:
Charleston, S. C., July 2, 1958. Q52:320
Gas Well Fire, Large Loss:
off Louisiana Coast, Oct. 15, 1958. Q52:248
Gasoline Dispensing Hose Nozzle Failed. Q52:244
See also Flammable Liquids
Gasometer Fire, Large Loss:
Indianapolis, Ind., Jan. 12, 1958. Q52:319
Geodesic Aluminum Domes. By David Warren. Q52:104–108, 151
German Fire Protection Association, Journal of. Q52:374
Gilman, Dale F. Q52:6
Glass Windows. *See Windows*
Grabowski, George J. Q52:109
Grass Dust, Research on. Q52:375
Grain Dusts. *See Dust*
Grease Ignited, Causing Fire. Q52:276, 277
Grinding Equipment, Explosion Supression for. Q52:115
Grocery Stores. *See Stores, Grocery*
Gypsum Wallboard, Behavior in Fire. Q52:194

H

Halogenated Hydrocarbon, Limitations of Combustible Gas Analyzers. Q52:364
Hangar (Aircraft) Fire, Large Loss:
Rimouski, Que., July 13, 1958. Q52:311
Hangar (Aircraft), Foam-water Sprinklers for. Q52:17–27
Hansberry, Harvey L. Q52:179
Hardboard, Combustible, Fire Spread by. Q52:75
Hardware Stores. *See Stores, Hardware*
Health Hazard of Materials, Identifying. Q52:62
Heating and Cooking Equipment, Fires Caused by. Q52:240, 241, 264, 276, 286, 291. *See also Incinerators*
Heating Ducts. *See Ducts*
Heating, Oil-fired Room Heaters, Fire Hazard. Q52:47, 48
Helicopter, Used in Fire Fighting. Q52:321, 322, 323, 330, 331
Hermes, Benjamin M. Q52:45
Historical Documents Lost in Fire. Q52:67–77, 243, 253, 258, 276
Hose, Burned at Fire. Q52:288
Hose, Standpipe. *See Standpipes*
Hotel Fire Safety, Upgrading in Winnipeg. Q52:28
Hotel Fires, Large Loss:
Berwick, Pa., Jan. 4, 1958. Q52:256
Gloucester, Mass., Dec. 11, 1958. Q52:270
Lac Beauport, P. Q., Nov. 19, 1958. Q52:292, 298
Old Orchard Beach, Me., Nov. 20, 1958. Q52: 255
Peterborough, Ont., Apr. 26, 1958. Q52:260, 277
Uranium City, Sask., Oct. 11, 1958. Q52:275
Hydrants:
Damaged or Inoperable. Q52:250, 316
Inaccessible During Fire. Q52:89
Hydrogen Bombs, Fire Effects of. Q52:53–61
Hydrogen, Involved in Fire. Q52:282

I

Identifying Fire Hazards of Materials. By J. S. Queener. Q52:62
Incendiary (Suspicious) Fires. Q52:238, 239, 245, 248, 255, 258, 264, 270, 276, 283, 286, 288, 298, 310, 322
Incinerators, Fire Originated at. Q52:273
Industial Plants, Multiple Occupancy:
Brooklyn, N. Y., Jan. 4, 1958. Q52:266
Rochester, N. Y., Feb. 11, 1958. Q52:272, 307
Inerting, Explosion Protection Technique. Q52: 109–119
Infrared Analyzers for Combustible Gases. Q52: 364
Insulation, Combustible:
Fire Spread by. Q52:242, 261, 263, 279, 310
Fire Tests of. Q52:191
Insulation Manufacturing Plant, Large Fires:
Walworth, Wisc., Jan. 27, 1958. Q52:262
Insurance Agents Responsibility for Large Loss Fires. Q52:336
Interior Finish, Combustible: *See also Fiberboard, Hardboard, Paperboard and Plywood*
Type Not Identified, Factor in Fire Spread. Q52:262
Interstate Commerce Commission. *See U. S.*
Ionization, Method of Reducing Static Hazard. Q52:79
Isolation, Automatic in Plant Machinery. Q52: 109–119
Isotopes. *See Radioisotopes*

J

Johnson-Williams, Inc., Combustible Gas Indicators. Q52:360, 363

K

Keigher, Don J. Q52:39
Kenilworth (Illinois) School Fire. Q52:175
Kiln Drying, Fire Involving. Q52:315
Kimball, Warren Y. Q52:125

L

Laboratory Studies, Fire Research. Q52:221
Ladder Manufacturing Plant Fire, Large Loss:
Los Angeles County, Calif., Nov. 20, 1958. Q52:280
Lamps. *See Light Bulbs*
Land Shipping Radioactive Materials. By D. E. Patterson and R. V. Batie. Q52:202
Large Loss Fires, 1958. Q52:235–356
Laughlin, Kyle P. Q52:53
Laundry Plant Fire, Large Loss:
Tacoma, Wash., Mar. 27, 1958. Q52:257
Laws, Fire. Q52:64, 151
Lead Poisoning of Combustible Gas Indicators. Q52:364
Leather Products Storage. *See Warehouses*
Library Fires, Large Loss:
Galesburg, Ill., May 9, 1958. Q52:243
Loretto, Pa., Jan. 23, 1958. Q52:258
Light Bulbs, Fires Caused by. Q52:241, 276
Light Fixture, Fluorescent, Fires Caused by. Q52:313
Lighting. *See Electrical*
Lightning, Fires Caused by. Q52:244, 264, 313, 321
Linen, Burning Characteristics of Clothing. Q52: 120
Liquefied Petroleum Gas. *See Gas*
Liquid Oxygen. *See Oxygen*

Little, Arthur D., Inc., Filters for Radioactive Dust. Q52:39
Los Angeles Basement Sprinkler Ordinance. Q52:6
Losses, Fire, in U. S., 1957. Q52:135
Lumber, Fire-retardant Treated, Performance in Bomb Tests. Q52:55
Lumber, Flameproofed, Fire Tests for. Q52:214
Lumberyard Fires, Large Loss:
Chicago, Ill., May 21, 1958. Q52:308
Corbin, Ky., July 23, 1958. Q52:291
Festus, Mo., Nov. 23, 1958. Q52:288
Klamath Falls, Ore., Feb. 20, 1958. Q52:296
Perth Amboy, N. J., June 7, 1958. Q52:288
Seattle, Wash., May 20, 1958. Q52:315

M

Machinery Storage. *See Warehouses*
Magnesium, Involved in Fires. Q52:249, 263, 332
Manholes, Combustible Gas Indicators for. Q52:358
Manufacturing Plants. *See Industrial Plants and Specific Occupancies*
Marinas, Large Loss Fires Involving:
Essington, Pa., Mar. 13, 1958. Q52:281
McHenry, Ill., Jan. 13, 1958. Q52:261
Matches. *See Smoking*
Materials, Identifying Fire Hazards of. Q52:62. *See also Specific Materials*
Metals, Effects of Foam-Forming Concentrates on. Q52:143
Metalworking (Aircraft Assembling) Plant Fire, Large Loss:
Santa Monica, Calif., Feb. 17, 1958. Q52:263
Metalworking (Aluminum Casting) Plant Fire, Large Loss:
McCook, Ill., Feb. 19, 1958. Q52:282
Metalworking (Aluminum Fabrication) Fire, Large Loss:
Barberton, Ohio, Apr. 9, 1958. Q52:244
Metalworking (Aluminum Refining) Plant Fire, Large Loss:
Baton Rouge, La., Aug. 22, 1958. Q52:303
Metalworking (Electrical Appliances Equipment) Plant Fire, Large Loss:
Los Angeles, Calif., May 16, 1958. Q52:294
Metalworking (Foundries) Plant Fires, Large Loss:
Bucyrus, Ohio, Dec. 17, 1958. Q52:315
McCook, Ill., Feb. 19, 1958. Q52:282
Salem Twp., Mich., Aug. 5, 1958. Q52:246
Metalworking (Steel Fabrication) Plant Fires, Large Loss:
Chattanooga, Tenn., Apr. 23, 1958. Q52:249
Cicero, Ill., Feb. 13, 1958. Q52:251
Genoa, Ill., Mar. 15, 1958. Q52:262
Louisville, Ky., Feb. 3, 1958. Q52:268
Monrovia, Calif., Apr. 12, 1958. Q52:242
Wilmington, Ohio, Feb. 27, 1958. Q52:250
Methane Tester. Q52:358
Mine Gases:
Fires Involving. Q52:283
Test Instruments for Measuring Concentrations Q52:358
Mine Safety Appliances Company, Combustible Gas Indicators. Q52:357–364
Model Studies, Use in Fire Research. Q52:221
Motion Picture Studio Fire, Large Loss:
Los Angeles, Calif., July 2, 1958. Q52:252, 253
Motion Picture Theatre. *See Theatre*
Motors, Electrical. *See Electrical Fires*
Multiple Occupancy Manufacturing Fires. *See Industrial Plants*
Multiple Occupancy Mercantile Fires. *See Stores, Multiple Occupancy*
Museum Fire, Large Loss:
New York, N. Y., Apr. 15, 1958. Q52:67, 267, 276
Mutual Aid. *See Protection, Public*

N

National Academy of Sciences. *See U. S.*
National Bureau of Standards. Q52:216–217
National Research Council. Q52:150, 221
Naval Research Laboratory. *See U. S.*
Nevada Bomb Test Fire Effects. By Kyle P. Laughlin. Q52:53
New York Museum Fire. By Rexford Wilson. Q52:67
NFPA Board. *See Board of Directors*
NFPA Handbook of Fire Protection. Q52:105
Nitromethane, Fires Involving. Q52:324
Noncombustible Buildings. *See Steel, Unprotected, and Aluminum, Unprotected*
Nuclear Bombs, Fire Effects of. Q52:53–61
Nylon, Burning Characteristics of Clothing. Q52:120

O

Occupancies, Estimates of 1957 Fire Experience by. Q52:135. *See also Specific Occupancies*
Occupancies, Lists of Large Loss Fires Involving. Q52:341
Occupants Fought Fire. *See Alarm Delayed*
Office Buildings and Bank Fires, Large Loss:
Baker, Ore., Dec. 2, 1958. Q52:273
Cincinnati, Ohio, Jan. 2, 1958. Q52:247
Oil Burners. *See Heating and Cooking*
Oil Froth Fire at Signal Hill Refinery. By Miles E. Woodworth. Q52:85. *See also Refineries*
Oil-soaked Floors, Walls. *See Floors*
Openings, Horizontal, Vertical, Unprotected. Q52:73, 155–175, 238, 241, 243, 255, 256, 258, 259, 262, 263, 265, 266, 269, 270, 271, 272, 273, 289, 291, 293, 298, 302, 316, 317
Openings. *See also Doors, Fire*
Openings, Vertical, Enclosure in Hotels. Q51:28–37
Operation Teapot. Q52:54–61
Operations Research in Fire. Q52:221
Orlon, Burning Characteristics of in Clothing. Q52:120
Outdoor Fire, Spread Beyond Control. Q52:149
Owners, Property, Responsibility for Large Loss Fires. Q52:336
Oxygen, Liquid, Fires Involving. Q52:299

P

Packing Materials, Fire Spread by. Q52:271
Paint Dipping, Fires Involving. Q52:280, 294
Paint, Flameproofing, Tests for. Q52:214
Paint in Cans, Fire Involving. Q52:73, 239, 276
Paintings, Damaged, Destroyed by Fire. Q52:67–77, 276
Pallets, Used in Shipping Radioactive Materials. Q52:203
Panic, During Fire. Q52:73, 160, 162–164
Paperboard, Combustible, Fires Spread by. Q52:64, 168, 194
Paper Shredding Machine, Cause of Fire. Q52:238
Paper Storage. *See Warehouse Fires*
Paper Working Fires, Large Loss:
Bayonne, N. J., Nov. 14, 1958. Q52:290, 309
Elnora, Ind., Feb. 1, 1958. Q52:242
Tampa, Fla., Feb. 22, 1958. Q52:286
Partitions, Fire Fighting Handicap. Q52:239, 276, 277, 305, 310. *See also Walls*
Patterson, D. E., Q52:202
Penthouse, Factor in Fire. Q52:294
Peterson, H. B. Q52:17
Petroleum. *See Flammable Liquids*

Pier Fires, Large Loss:
Camden, N. J., Feb. 18, 1958. Q52:297
Orange, Tex., June 4, 1958. Q52:237
Pensacola, Fla., Nov. 20, 1958. Q52:285
Portland, Ore., Sept. 11, 1958. Q52:293
Piling, High. *See Storage, Improper*
Pipes, Thawing, Fires Caused by. Q52:259, 297
Piping, Flammable Liquid, Failed in Fire. Q52:89
Planning for School Fire Safety. Q52:176
Plastic Binder of Insulation. Q52:263
Plastics:
Fire Tests of. Q52:217
Involved in Fire. Q52:264, 278, 279
Performance in Bomb Fire Tests. Q52:57
Platforms, Loading, Fires Spread by. Q52:249
Plywood:
Fire Spread Influenced by. Q52:64, 194, 276
Fire Tests of. Q52:217
Porches, Combustible, Hazards of. Q52:46
Portland, Ore., Fire Code. Q52:7, 10
Pottery Plant Fire, Large Loss:
Compton, Calif., Dec. 7, 1958. Q52:245
Power Plant Electrical Fire, Large Loss:
Baton Rouge, La., Aug. 22, 1958. Q52:303
Prefabricated Homes, Manufacturing Plant, Large Fire In:
Fort Wayne, Ind., June 16, 1958. Q52:274
Prevention, Fire, by Fire Dept. Q52:125–134
Printing Plant Fire, Large Loss:
Dixon, Ill., Feb. 16, 1958. Q52:309
Protection, Private, Table of Defects Influencing Fire Spread in Large Loss Fires. Q52:341
Protection, Public, Fire:
Apparatus Damaged at Fire. Q52:308, 309
Equipment Breakdown. Q52:312
Fire Department, Job of. Q52:125–134
Fire Prevention Bureaus. Q52:65
Inspection of Dwellings. Q52:51
Long Running Distance Delays Response. Q52:311
Outside Aid Needed at Fires. Q52:95, 250, 251, 260, 279, 288, 296, 305, 309, 316, 322
Response on First Call Inadequate. Q52:159, 164, 262, 309, 310, 312, 313, 315
Table of Factors Influencing Fire Spread in Large Loss Fires. Q52:337
Weak at Fires. Q52:242, 246, 247, 258, 291, 309, 312, 313, 315
Public Buildings, Large Loss Fires in:
Galesburg, Ill., May 9, 1958. Q52:243
Pulverized Fuel Plant, Explosion Suppression Equipment for. Q52:117
Pumps, Fire:
Failure During Fire. Q52:298, 308
Fire in Pump House Prevented Operation. Q52:296

Q

Queener, J. S. Q52:62

R

Radiation, Heat, Bomb Tests. Q52:53–61
Radiation Sensitive Detector. Q52:77
Radio Communications, Fire Department. Q52:97, 129
Radio Studio Fire, Large Loss:
Battle Creek, Mich., July 21, 1958. Q52:277
Radioactive Filters, Design Fire Problems. By Don J. Keigher. Q52:38
Radioactive Materials, Land Shipping of. By D. E. Patterson and R. V. Batie
Radioactive Materials, Use in Reducing Static Hazard. Q52:79
Radioactivity, Effects of During Bomb Fire Tests. Q52:53–61
Radioisotopes, Land Shipping of. Q52:202
Rag Storage. *See Warehouse Fires*
Railroad Car Shop Fire, Large Loss:
Williamsport, Pa., Oct. 8, 1958. Q52:302
Railroad Rolling Stock, Large Loss Fires Involving:
Mount Pulaski, Ill., June 1, 1958. Q52:324
Niagara Falls, N. Y., Jan. 22, 1958. Q52:324
Shattuck, Okla., Mar. 4, 1958. Q52:324
Railroads, Shipping Radioactive Materials by. Q52:202
Ram Jet Test Cell, Explosion Suppression Equipment for. Q52:117
Rayon, Burning Characteristics of Clothing. Q52:120
Reactivity, Identifying Hazard of Materials. Q52:62
Records in Safes, Recovered Intact. Q52:213
Records Lost in Fire. Q52:238, 253, 258
Refineries, Petroleum, Fires, Large Loss:
Alma, Mich., Feb. 15, 1958. Q52:320
Signal Hill, Calif., May 22, 1958. Q52:85–98, 320
Rescues Accomplished by Fire Department Ladders. Q52:73, 163, 164, 166
Research, Fire. *See also Tests, Fire.* Q52:17, 150, 221
Research Tests with Foam-water Sprinklers. By H. B. Peterson. Q52:17
Residential Properties. *See Specific Occupancy*
Restaurants. *See Stores, Restaurants*
Reviews, Abstracts of Technical Papers. Q52:77, 143, 374
Rocketeers, Teen-age, Supervision of. Q52:99–103
Roof Coverings, Asphalt or Tar, Fire Spread by. Q52:258, 294
Roof Decks, Fire Tests of. Q52:186–192, 218, 219
Roof, Mansard, Fire Hazard of. Q52:46
Roof Spaces. *See Attics and Roof Spaces*
Rubber, Foam, Fires Involving. Q52:278
Rubbish and Trash:
Exterior, Effect on Fire Hazard. Q52:48, 61
Fires Involving. Q52:175, 273, 281, 302
Fire Originating in. Q52:265

S

Safes. *See Records*
Salamanders, Fires Caused by. Q52:240, 284
Salvage, Operations. Q52:74, 264
Saw and Planing Mills. *See Woodworking Plant Fires*
Schlyter Apparatus. Q52:214
School Fire Problem. Q52:150, 176
School Fires: *See Also Colleges*
Charlotte, N. C., Oct. 31, 1958. Q52:268
Chicago, Ill., Dec. 1, 1958. Q52:155
Clinton, Mass., Feb. 6, 1958. Q52:273
East Chicago, Ill., Jan. 18, 1958. Q52:270
Jefferson, Texas, Nov. 9, 1958. Q52:246
Kenilworth, Ill., Dec. 16, 1958. Q52:175
Providence, R. I., July 25, 1958. Q52:239
Sturgeon Falls, Ont., Nov. 11, 1958. Q52:313
Swarthmore, Pa., Apr. 6, 1958. Q52:218
Sewers:
Combustible Gas Indicators for Measuring Vapors in. Q52:358
Gas Explosions in. Q52:283, 311
Flammable Liquids in. Q52:87
Shades, Window, Effect on Reducing Heat Radiation. Q52:58–60
Shafts. *See Openings*
Shaw, Capt. Carroll E. Q52:99
Shell Oil Company, Fire Research by. Q52:79
Shingles. *See Wood Shingles*
Ship and Barge Fires, Large Loss:
East River, N. Y., June 25, 1958. Q52:322
Newport Harbor, R. I., Aug. 7, 1958. Q52:323
Shipping Radioactive Materials. Q52:202
Shipyard Fires. *See Marinas*
Shopping Centers. *See Stores, Shopping Centers*
Signal Hill, Calif., Refinery Fire. Q52:84–98
Silicone Poisoning of Combustible Gas Indicators. Q52:364
Silk, Burning Characteristics of Clothing. Q52:120

Silk, Measuring Flammability of. Q52:375
Simpson, E. G. Q52:28
Sirup Manufacturing Plant Fire, Large Loss:
Cleveland, Ohio, Jan., 20, 1958. Q52:244
Sisal Storage. *See Warehouse Fires*
Six Items for Dwelling Construction Codes. By Richard E. Stevens. Q52:193
Smithman, Milton W. Q52:193
Smoke Barriers, in Hotel Corridors. Q52:27–38
Smoke Damage, Factor in Loss. Q52:75, 260, 263, 264, 286, 291
Smoke Detection Systems. *See Detection Systems, Smoke*
Smoke, Fire Fighting Handicap. Q52:74, 155–175, 238, 260, 262, 263, 271, 273, 277, 287, 299, 317
Smoking, Matches, Fires Caused by. Q52:73, 157, 241–242, 276, 289, 321
Smouldering Combustion in Dusts and Fibrous Materials. Q52:375
Snow, Fire Fighting Handicap. Q52:259, 307
Solvents. *See Flammable Liquids*
Southwest Research Institute. Q52:213
Sprinklers:
Automatic, General. Q52:28–37
Basement, Need for. Q52:6–11, 71
Distribution Obstructed by High Piled Stock. Q52:279
Dome Structures, Protected by. Q52:107
Exposure Protection, Effective Inside. Q52:250, 253, 255, 291, 293
Exposure Protection, Effective Outside. Q52:280, 286
Filter Rooms, for. Q52:44
Fire Department Connection Not Used During Fire. Q52:253, 291, 309
Fire Department Connection Used During Fire. Q52:293, 308
Foam-water, Research on. Q52:17–27
Hotels, Protected by. Q52:27–38
Partial in Buildings, Effective. Q52:271, 293
Partial in Buildings, Ineffective. Q52:239, 292, 298
Partial in Buildings, Not a Factor. Q52:71, 292
Pressure Tank System Involved. Q52:292, 298
Satisfactory Performance in Fires. Q52:6, 175, 263, 299, 306, 308
Schools, Requirements for. Q52:177
Shut Off Prematurely During Fire. Q52:315
Unsatisfactory Performance in Fires. Q52:253, 270, 279, 290, 291, 293, 294, 295, 298, 309
Valves Closed at Time of Fire. Q52:243, 260, 272, 291, 307
Stability, Identifying Hazard of Materials. Q52:62
Stairways. *See Openings*
Standards, National, Use of. Q52:64–66
Standpipe and Hose Systems:
Satisfactory Performance During Fires. Q52:306
Unsatisfactory Performance During Fires. Q52:74, 248, 300, 301, 302, 316
Static Electricity:
Experiments on Prevention. Q52:143
In Petroleum Products. Q52:78, 79
Inside Storage Tanks. Q52:79
Steam Explosion in Oil Tanks. Q52:85
Steel Fabricating Plant Fires. *See Metalworking*
Steel Geodesic Domes. Q52:104–108
Steel, Unprotected, Damaged by Fire. Q52:248, 260
Steiner, A. J. Q52:209
Stetka, Frank, Appointment as Electrical Field Engineer. Q52:14
Stevens, Richard E. Q52:193
Stone Working Fires, Large Loss:
Monon, Ind., June 8, 1958. Q52:313
Walworth, Wisc., Jan. 27, 1958. Q52:262
Storage, Improper, Influencing Fire Spread. Q52:276, 279, 280, 286
Storage. *See Warehouses*
Store Fires, Editorial. Q52:151
Store Fires, Large Loss:
Clothing and Dry Goods:
Amarillo, Texas, Apr. 3, 1958. Q52:241
Department:
Asheboro, N. C., Aug. 14, 1958. Q52:264
Baltimore, Md., Feb. 18, 1959. Q52:259
Bogota, Colombia, Dec. 16, 1958. Q52:148, 151
Boise, Idaho, June 18, 1958. Q52:256
Jacobus, Pa., Feb. 9, 1958. Q52:316
Savannah, Ga., May 20, 1958. Q52:254, 255
Stockton, Calif., July 22, 1958. Q52:289
Five Cent to a Dollar:
Oshawa, Ont., Sept. 2, 1958. Q52:239
Furniture:
Pekin, Ill., Sept. 15, 1958. Q52:272
Quebec, P. Q., July 9, 1958. Q52:238
Grocery:
Evansville, Ind., Nov. 11, 1958. Q52:265
Hardware:
Decatur, Ill., Jan. 1, 1958. Q52:277
Joliette, P. Q., Feb. 4, 1958. Q52:251
Madison, Wisc., Jan. 5, 1958. Q52:311
Streator, Ill., July 14, 1958. Q52:282
Vergennes, Vt., Feb. 24, 1958. Q52:265
Wildwood, N. J., Apr. 14, 1958. Q52:286
Multiple Occupancy:
Baker, Ore., Dec. 2, 1958. Q52:273, 335
Belleville, Ont., Nov. 29, 1958. Q52:283
Calais, Me., Mar. 4, 1958. Q52:293
Clearwater, Fla., Mar. 17, 1958. Q52:237
Lodi, N. J., July 29, 1958. Q52:305
Milwaukee, Wis., Feb. 10, 1958. Q52:317
Nampa, Idaho, Jan. 8, 1958. Q52:312
Pen Argyl, Pa., Jan. 5, 1958. Q52:287
San Francisco, Calif., Aug. 5, 1958. Q52:276
Washington, D. C., Feb. 19, 1958. Q52:271
Restaurants:
Knoxville, Tenn., May 9, 1958. Q52:241, 305
Lincolnwood, Ill., May 13, 1958. Q52:238
Syracuse, N. Y., June 3, 1958. Q52:276
Shopping Centers:
Houston, Texas, July 24, 1958. Q52:263
Toledo, Ohio, Jan. 25, 1958. Q52:248
Supermarkets:
Clarksburgh, W. Va., Feb. 25, 1958. Q52:268
Clearwater, Fla., Mar. 17, 1958. Q52:237
Detroit, Mich., Mar. 7, 1958. Q52:240
Jacksonville, Fla., May 1, 1958. Q52:314
Los Angeles, Calif., Oct. 14, 1958. Q52:303
Stores, Basement Sprinklers for. Q52:6–11
Sulphur Grinding Plant, Explosion Suppression Equipment for. Q52:116
Supermarkets. *See Stores, Supermarkets*
Supervision of Teen-age Rocketeers. By Capt. Carroll E. Shaw. Q52:99
Suspicious Fires. *See Incendiary*
Sweaters, "Torch." Q52:122

T

Tanks, Aircraft Fuel, Explosion Suppression Systems for. Q52:78, 109
Tanks, Flammable Liquid, Failed in Fire. Q52:85–98
Tar Paper, Factor in Fire Spread. Q52:258
Tarpaulin:
Fires Involving. Q52:73, 276
Flameproofed, Fire Tests for. Q52:209
Tenting, Flameproofed, Fire Tests for. Q52:209
Terminal Warehouses. *See Warehouse Fires*
Test, Nevada Bomb, Fire Effects. Q52:53
Tests, Fire, Building Materials. Q52:64–66, 182–192, 204–220
Tetraethyl Lead, Tank Exposed in Fire. Q52:92
Textiles, Flameproofed. Q52:209
Textiles, Measuring Flammability of. Q52:375
Textile Storage. *See Warehouse Fires*

Textile Working Plant Fire, Large Loss:
Pinckneyville, Ill., May 6, 1958. Q52:286
Thawing Pipes, etc., Cause of Fire. *See Pipes, Thawing*
Theater (Motion Picture) Fire, Large Loss:
Calais, Maine, Mar. 4, 1958. Q52:293
Thompson, Norman J. Q52:186
Tobacco Storage. *See Warehouse Fires*
Torches, Cutting and Welding, Fires Caused by. Q52:242, 243, 261, 279, 293, 311, 334
Torch, Gas Fired, Fires Caused by. Q52:274, 275
Toxicity, Measuring Maximum Allowable Concentration. Q52:359
Traffic, Delayed Fire Department Response. Q52:296
Training, Fire Fighting. Q52:131
Transformer Fire, Large Loss:
Center Twp., Ohio, July 22, 1958. Q52:320
Transmission Gas Line, Fire Caused by. Q52:320
Transoms:
Hotel Bedrooms, Hazard of. Q52:37
Schoolrooms, Fire Spread Through. Q52:160, 168
Transportation. *See Aircraft, Ships, Railroad Rolling Stock, Trucks*
Transporting Radioactive Materials. Q52:202
Trash. *See Rubbish*
Tribute to Dick Vernor. By Percy Bugbee. Q52:5
Triethylaluminum, Fire Tests of. Q52:143
Trimethyaluminum, Fire Tests of. Q52:143
Trucks. *See also Apparatus; Protection, Public, Apparatus*
Fire in, Spread to Building. Q52:266
Industrial, Involved in Fire. Q52:241
Shipping Radioactive Materials by. Q52:202
Tunnel Test, Surface Burning Characteristics of Building Materials. Q52:212

U

Underwriters' Laboratories, Inc. Q52:17, 209
Underwriters' Laboratories of Canada. Q52:213
U. S. Air Force. Q52:77, 78, 144
U. S. Atomic Energy Commission. Q52:39, 53–61, 202
U. S., Federal Civil Defense Administration. Q52:53–61, 221
U. S. Interstate Commerce Commission, Regulations on Shipping Radioactive Materials. Q52:203
U. S. National Academy of Sciences. Q52:150, 221
U. S. National Bureau of Standards. Q52:216, 217
U. S. National Research Council. Q52:150, 221
U. S. Naval Research Laboratory. Q52:17, 143
U. S. Program of Fire Research. By Howard W. Emmons. Q52:221
Upgrading Hotel Fire Safety in Winnipeg. By E. G. Simpson. Q52:28
Use of Combustible Gas Indicators. By N. W. Hartz. Q52:357

V

Vacant Building Fire, Large Loss:
Chicago, Ill., Jan. 1, 1958. Q52:310
Vapors, Combustible Gas Indicators for Measuring Concentrations of. Q52:357
Venetian Blinds, Effect on Reducing Heat Radiation. Q52:58–60
Ventilating Ducts. *See Ducts*
Ventilating Systems:
Dust, Factor in Fire Spread. Q52:284
Radioactive Dusts, Filtering. Q52:39
Vents:
Flammable Liquid Tanks. Q52:85–93
Gas Heater, Improper Installation Factor in Fire. Q52:196, 240, 291
Smoke, Improper Use of During Fire. Q52:299
Smoke, Lack of Factor in Fire. Q52:172, 241, 279, 289
Stove, Improper Installation Factor in Fire. Q52:305
Vernor, Richard E. (Frontispiece) In Memoriam. Q52:4

W

Wall and Ceiling Concealed Spaces, Firestopping in Dwellings. Q52:193–201
Wall and Ceiling Concealed Spaces Nonfirestopped, Factor in Fire Spread. Q52:46, 200, 239, 240, 241, 253, 263, 266, 270, 273, 274, 276, 277, 291, 293, 313, 315, 316
Wallboard, Combustible. Q52:64, 168, 169. *See Also Fiberboard; Hardboard; Interior Finish, Combustible; Paperboard; Plywood*
Walls: *See Also Construction*
Blank, Fire Fighting Handicap. Q52:69, 243, 259, 279, 310
Exterior, Collapse During Fires. Q52:287, 309
Fire Division, Effective During Fires. Q52:295
Fire Division, Ineffective During Fires. Q52:237, 250, 260, 269, 270, 274
Fire Division, Lack of Factor in Fire Spread. Q52: 157–170, 238, 241, 242, 244, 246, 250, 253, 264, 270, 276, 297, 302, 305
Fire Division, Non-standard, Effective During Fire. Q52:248, 261
Fire Division, Parapet Ineffective During Fire. Q52:250, 272, 281
Fire Division, Parapet Lacking During Fire. Q52: 237, 268
Fire Tests of Assemblies. Q52:210
Windowless. *See Walls, Blank*
Warehouse Fires, Large Loss:
Building Materials:
Chicago, Ill., July 2, 1958. Q52:244
Cold Storage:
Richmond, Va., Jan. 16, 1958. Q52:283
Cotton Storage:
Memphis, Tenn., Jan. 31, 1958. Q52:293
Drugs Storage:
Boise, Idaho, Sept. 28, 1958. Q52:243
Electrical Equipment Storage:
Los Angeles County, Calif., June 29, 1958. Q52: 246
Fireworks:
Portland, Ore., July 5, 1958. Q52:245
Food and Grocery:
Nashville, Tenn., Mar. 21, 1958. Q52:279
Furniture Storage:
Greenville, S. C., Apr. 20, 1958. Q52:271
Tampa, Fla., Oct. 27, 1958. Q52:278
Leather Products:
Los Angeles, Calif., Jan. 22, 1958. Q52:317
Machinery Storage:
Ogallaha, Neb., Apr. 28, 1958. Q52:247, 295
Miscellaneous Storage:
Erie, Pa., Feb. 13, 1958. Q52:264
Hamilton, Ohio, Dec. 12, 1958. Q52:276
Ketchikan, Alaska, Oct. 3, 1958. Q52:239
Sault St. Marie, Ont., Oct. 29, 1958. Q52:302
Paper Warehouse:
Asheville, N. C., July 1, 1958. Q52:280
Rag Storage:
Cincinnati, Ohio, Feb. 13, 1958. Q52:259
Sisal:
Gulfport, Miss., Apr. 14, 1958. Q52:299
Terminal Warehouse:
Orange, Texas, June 4, 1958. Q52:237
Textile:
Louisville, Ky., Jan. 5, 1958. Q52:291
Tobacco:
Mount Joy, Pa., Dec. 24, 1958. Q52:271
Warren, David. Q52:104, 151
Watchman:
Responsibility for Large Loss Fires. Q52:336

Satisfactory Performance at Fires. Q52:238, 253, 308
Service at Large Loss Fires. Q52:251, 263, 270, 296, 311
Unsatisfactory Performance at Fires. Q52:252, 253, 256, 259, 276, 281, 311
Water Spray Sprinklers, Comparison with Foam-water. Q52:17–27
Water Spray Systems:
Damaged at Fire, Ineffective. Q52:296
Flammable Liquid Tanks. Q52:92
Research on Fires in Liquids. Q52:376
Transformers. Q52:321
Water Spray, Use on Aluminum Alkyl Fires. Q52:143
Water Supplies:
Private Supply Inadequate. Q52:298, 305
Public Supply Inadequate. Q52:243, 244, 248, 279, 295, 298, 302, 304, 305, 309, 311, 314, 316
Wearing Apparel. *See Clothing*
Weather, Fire Fighting Handicap. Q52:310, 312, 316, 321, 322, 325. *See also Snow and Wind*
Wharfs. *See Piers*
What is the Fire Department's Job? By Warren Y. Kimball. Q52:125
White-wash, for Windows, Effect on Reducing Heat Radiation. Q52:58–60
Wilson, Rexford. Q52:67, 155
Wind, Effect on Fire. Q52:249, 288, 307, 321
Windowless Buildings. *See Walls, Blank*
Windows:
Blown out by Dust Explosion. Q52:285
Coatings for, Performance in Bomb Fire Tests. Q52: 58–60
Dwellings, Use of. Q52:196, 197
Fire Tests for. Q52:219
Obstructed by Stored Materials. Q52:277, 317
Ordinary Glass, Fire Spread Through. Q52:244, 265, 270, 275, 286, 288, 291
Protection Problems. Q52:74
Wired Glass, Ineffective. Q52:89
Winnipeg, Hotel Fire Safety in. Q52:28
Wood Dust, Research on. Q52:375
Wood, Flameproofed, Fire Tests for. Q52:214
Wood Flour Plant, Explosion Suppression Equipment for. Q52:116
Wood Shingle Roofs. Q52:64, 149, 150, 288
Woodworking Plant Fires, Large Loss:
Furniture Factories:
Chicago, Ill., May 21, 1958. Q52:308
Saw and Planing Mills:
Coeur d'Alene, Idaho, July 28, 1958. Q52:297
Council, Idaho, Aug. 17, 1958. Q52:296
Klamath Falls, Ore., Feb. 20, 1958. Q52:267, 296
Rutland, Vt., Oct. 12, 1958. Q52:314
Seattle, Wash., May 20, 1958. Q52:315
Woodworth, Miles E. Q52:7, 85
Wool, Burning Characteristics of Clothing. Q52: 120
Wool, Measuring Flammability of. Q52:376
Wright Air Development Center, Fire Research by. G52:77, 78, 144

Y

Yacht Yards. *See Marinas*
Yockers, Joe R. Q52:120

Index to Advertisers — April 1959

	Page
American District Telegraph Company (ADT)	A1
American LaFrance, Division of Sterling Precision Corporation	A7
Ansul Chemical Company	A27
Armstrong Cork Company	A3
"Automatic" Sprinkler Corporation of America	A38
Cardox, Division of Chemetron Corporation	*Inside Front Cover*
Celotex Corporation	A13
Central Station Electrical Protection Association	A16
Central Station Signals, Inc.	A12
Chicago Bridge & Iron Company	A25
Porter D. Dilley	A26
Fyr-Fyter Company	A35
Gamewell Company	*Inside Back Cover*
Grinnell Company, Inc.	*Back Cover*
Gustin-Bacon Manufacturing Company	A23
Walter Kidde & Company, Inc.	A21, A29
Kinnear Manufacturing Company	A33
Koppers Company, Inc., Wood Preserving Division	A20
Kuhns Brothers Company	A19
M & H Valve and Fittings Company	A37
R. C. Mahon Company	A31
Minneapolis-Honeywell Regulator Company	A36
National Foam System, Inc.	A5
Notifier Corporation	A22
Overly Manufacturing Company	A14, A15
Pittsburgh-Des Moines Steel Company	A34
Raisler Corporation, Raisler Sprinkler Division	A8
Reeve Electrical Company, Inc.	A18
Reliable Automatic Sprinkler Company, Inc.	A24
Rockwood Sprinkler Company	A17
Star Sprinkler Corporation	A10
Tokheim Corporation, General Products Division	A32
Van Loon Industries	A6
Van-Packer Company, Division of The Flintkote Company	A28
Vapor Recovery Systems Company	A4
Victaulic Company of America	A11
Viking Corporation	A30
Vonnegut Hardware Company, Von Duprin Division	A2
William Wallace Company, Metalbestos Division	A9

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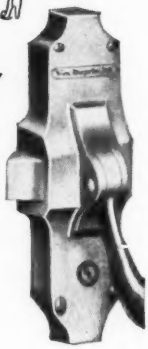


Underwriters' Laboratories gives new Armstrong Acoustical Ceiling two-hour fire rating

New Armstrong Acoustical Fire-Guard ceiling eliminates the need for costly intermediate fire-stops

The new Armstrong Acoustical Fire-Guard ceiling is the latest product of Armstrong research. Underwriters' Laboratories, Inc., in its Retardant Report #4177-1, stated that a floor-ceiling assembly utilizing Armstrong Acoustical Fire-Guard ceiling tile, "will afford two-hour fire protection against the passage of flame or dangerous transmission of heat." It also reported that this system, when tested, protected bare steel joists for a period exceeding six hours.

Armstrong Acoustical Fire-Guard eliminates the need for costly intermediate fire-stops. Previously, it was necessary to (1) utilize reinforced concrete construction, or (2) spray steel structural members with an insulating material, or (3) suspend a lath and plaster fire-stop to which the acoustical ceiling tile could be applied.

For complete information about new and economical Armstrong Acoustical Fire-Guard, see Underwriters' Laboratories, Inc., Retardant Report #4177-1. Or write to Armstrong Cork Company, 4204 Woodbridge Street, Lancaster, Pennsylvania.

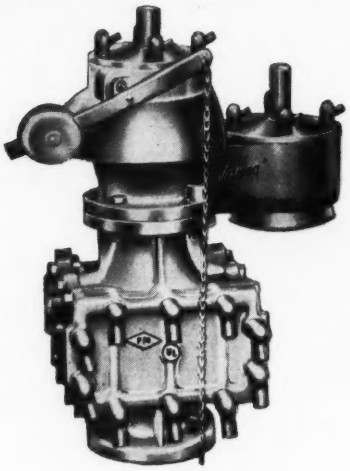
Armstrong ACOUSTICAL CEILINGS

EXTRA SAFETY at LOW COST...

"Varec"

FLAME ARRESTERS

in combination with your
VENT VALVES



Flame Arrester Unit
listed by
UNDERWRITERS' LABORATORIES
Approved by Associated Factory Mutuals
Laboratories and other governing agencies.

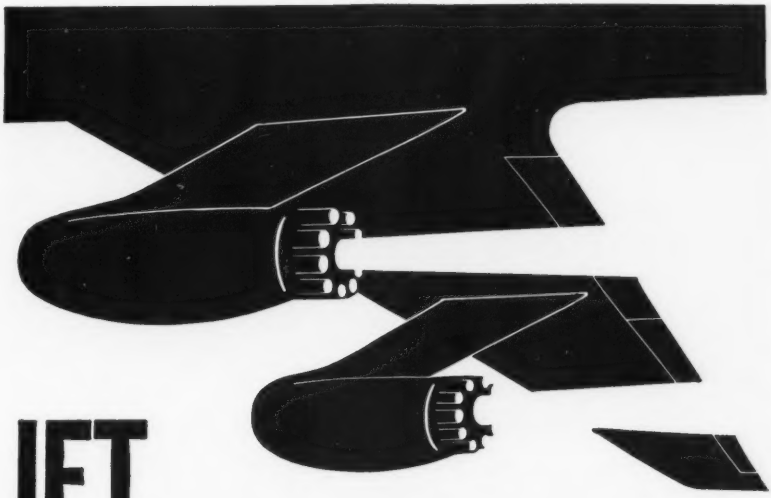
"Varec" Fig. No. 5800 Vent Unit consisting of "Varec" Conservation Vent Valve in combination with "Varec" Flame Arrester.

The larger area of the multi-plate Flame Arrester bank, greater flow per minute through the Flame Arrester passageways are the "plus" factors to give you extra safety when you install "Varec" Conservation Vent Units. Protection against entry of flame through the venting device is certain when "Varec" Flame Arresters are used. Excessive pressure or vacuum is avoided by use of the "Varec" Vent Valve. The combination unit gives you complete security against the major hazards of flammable liquid storage yet average installation approximately 1/10 of 1% of your investment in tank and product. Consult your nearest "Varec" representatives or write factory.

N.F.-5

"Varec"

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 NORTH ALAMEDA STREET
COMPTON, CALIFORNIA
Cable Address: VAREC COMPTON CALIF.
(U.S.A.) All Codes



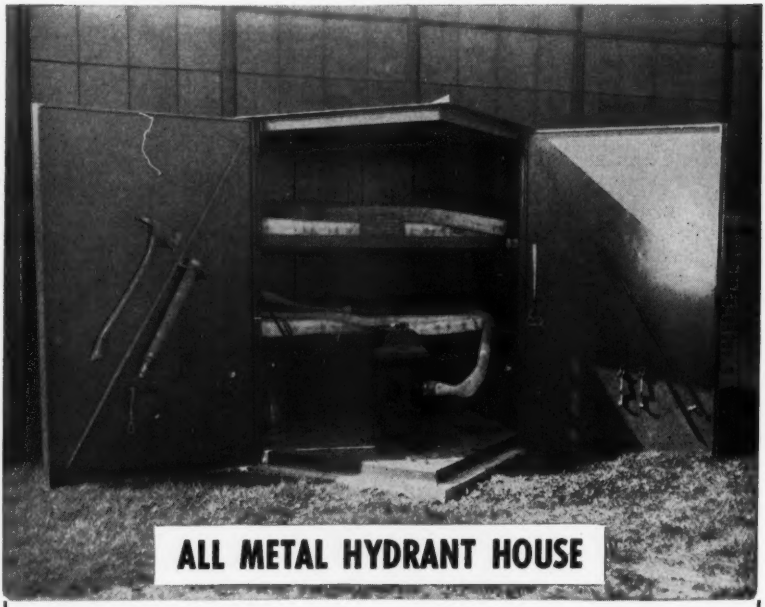
JET TRANSPORT

...another advance in the age of flight

Each increase in jet fuel production augments the need for **control of fire in flammable liquids.**

Another vital industry served by

NATIONAL FOAM System, Inc.
West Chester, Pa.



— FACTORY MUTUALS APPROVED —

Many Architects and Engineers are specifying the Model 60 or 60-L ALL-METAL Hydrant House on new jobs and recommend their use for replacement of existing wooden houses as they wear out.

The advantage of a Hydrant House is that it protects the hose and hydrant during inclement weather when sleet or snow cause heavy icing. The hose is coupled and ready at any hour of the day or night. All metal houses are weathertight and rat proof — will not warp or dry out. Eight (8) Louvers are stamped in side panels and shelves are perforated for ventilation. Finished weights — 600 lbs. and 650 lbs.

Houses are shipped from stock, knocked down. Roof, base, shelves, doors and panels are completely prefabricated of **galvanized iron with zinc plated hardware. Hinges are brass pinned.** All bolts for assembly are furnished. No cutting, drilling or welding is required in the field, thereby reducing the installation time to a minimum. Instructions are furnished for a simplified concrete foundation slab.

Manufactured by

VAN LOON INDUSTRIES

ENGINEERS AND FABRICATORS

3409 East McNichols Road Detroit 12, Michigan

TWinbrook 3-4460 TWinbrook 3-4461

CUSTOM HOSE CABINETS MADE TO YOUR SPECIFICATIONS

You are invited to attend the
AMERICAN LAFRANCE
1959 INDUSTRIAL
Fire School

Snuffing a gasoline fire with Carbon Dioxide

There are frequent question-and answer sessions

BRING YOUR SPECIAL PROBLEMS WITH YOU

Here's a timely opportunity to further your knowledge of the latest in equipment and techniques in fighting *industrial* fires. Attend the 1959 session, American LaFrance Industrial Fire School, to be held at our experimental testing grounds near our plant in Elmira, N. Y.

You will use all types of portable extinguishers on live fires . . . participate in class discussions ranging from fundamental elements of fire protection to the most up-to-date methods of equipment use. Opening date for the first 3-day session is May 12th. Attendance is free, including luncheons for each 3-day session. For reservation blanks and complete information on the program write direct to:

AMERICAN LAFRANCE

DIVISION OF STERLING PRECISION CORPORATION
ELMIRA, N.Y., U.S.A.
In Canada, LaFrance Fire Engine and Foamite, Ltd., Toronto, Ont.

NEW IMPROVED GRIMES MODEL AB SUPER ACCELERATOR

SPEEDS UP DRY PIPE VALVE OPERATION

ALL BRONZE

EASY TO INSTALL

SIMPLE TO SERVICE

FIRE SPRINKLER SYSTEMS AND EQUIPMENT

Engineered for better protection

ALARM VALVES
WATER MOTORS
VALVE DEVICES
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RETARD CHAMBERS
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EMERGENCY CABINETS
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SPRINKLERS — ALL TYPES AND FINISHES

WATCH FOR ANNOUNCEMENT OF THE NEW GRIMES MODEL B DRY PIPE VALVE.

Write Now for Descriptive Literature.

There is a Grimes Licensed Representative near you who is equipped to design and install a fire sprinkler system to meet your specific needs.

Grimes Devices are approved by all Insurance Interests.

RAISLER
SPRINKLER DIVISION

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Licensees in all principal cities in the United States and Canada

HERE'S WHERE THE LIGHTS BURN LATE!

Keeping up-to-date on new building developments that affect his community's health and safety is often "after hours" work for the busy Building Inspector . . . except in the important field of gas venting. Here, he can call upon the complete technical resources and services of the Metalbestos Division, William Wallace Company for immediate, accurate answers to his venting questions.

For your complimentary copy of the new Metalbestos "Safety System" Gas Vent Tables, call your nearest Metalbestos representative or write to Dept. T-4

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METALBESTOS DIVISION
WILLIAM WALLACE COMPANY · BELMONT, CALIF.

STARGARD

GIVES YOU MORE — FOUR WAYS

UPRIGHT SPRAY SPRINKLER

APPROVED BY
FACTORY MUTUAL LABORATORIES

PENDENT SPRAY SPRINKLER

SIDEWALL SPRINKLER

LISTED BY
UNDERWRITERS' LABORATORIES, Inc.

SMALL ORIFICE SPRINKLER
(With Identifying Pintle)

1 **SUPERIOR PROTECTION** . . . due to more efficient water distribution. Proven by tests under actual fire conditions for all classes of hazards.

2 **MORE EFFECTIVE USE OF LESS WATER** . . . because wider distribution and break-up of the water discharged provides greater cooling and extinguishment.

3 **CEILING PROTECTION BY COOLING — NOT WETTING** . . . All the water goes onto the fire. The break-up of water results in complete cooling and control of flammable vapors.

4 **MORE FIRE CONTROL WITH FEWER SPRINKLERS** . . . because ceiling temperatures are kept lower, fewer sprinklers open. Immediate water saturation of the fire area prevents the spread of fire. Hot gases become impotent in the cooled atmosphere.

STAR SPRINKLER CORPORATION

Westmoreland & Collins Sts., Phila. 34, Pa.

Licensees in principal cities of the United States and Canada

VICTAULIC

METHOD OF PIPING

VICTAULIC COUPLINGS

Styles 77, 77-D for standard applications. Simple, fast to install — sturdy and reliable. Sizes ¾" to 30". Style 75 Light-Weight Couplings for light-duty applications. Sizes 2" to 8". Additional styles for cast iron, plastic and other pipes. Sizes through 60".

ROUST-A-BOUT COUPLINGS

Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky — easy and fast to install. Takes strong bull-dog grip on pipe. Sizes 2" to 12".

VICTAULIC FULL-FLOW FITTINGS

Complete line of Elbows, Tees, Reducers, Laterals, etc. — to fit all Victaulic Couplings. Streamlined for top efficiency, easy to install. Sizes ¾" to 12".

VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the job in half the time. Light weight, easy to handle — operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".

APPROVED BY:

Underwriters' Laboratories, Inc.
Factory Mutual
New York City Board of Standards and Appeals, Cal. #413-53-SM.

Proven for 28 years on both wet and dry Fire Protection Systems. Standard with most major sprinkler companies for bulk-run and cut-in piping. Victaulic Couplings are installed in *less than one-half the time* required for other standard pipe joints.

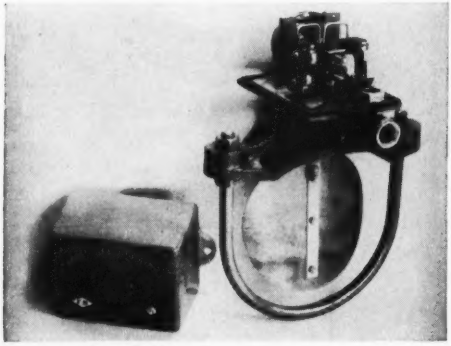
THE EASIEST WAY TO MAKE ENDS MEET

VICTAULIC
COMPANY OF AMERICA
P.O. Box 509, Elizabeth, N. J.

CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station Systems or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

53 WEST 23rd STREET . . . . . NEW YORK 10, N. Y.



Model PRS-1

Sprinkler Waterflow Alarm

This device is approved by Factory Mutual Laboratories and Underwriters' Laboratories, Inc.

- This device is also made as Model PRT-1, a coded waterflow transmitter.

5-inch size shown above. To install simply drill 2-inch hole in pipe.

- Also made in explosion proof models.
- Made in all sizes from 2½" to 8".
- Has instantly recycling pneumatic retarding device, preventing false alarms.
- Has enclosed electrical contacts for any voltage not exceeding 15 amp. 125 volts, A.C. and ½ amp. 125 volts, D.C. Operates on all water pressures or surges.

Size is 1⅝" x ⅝"

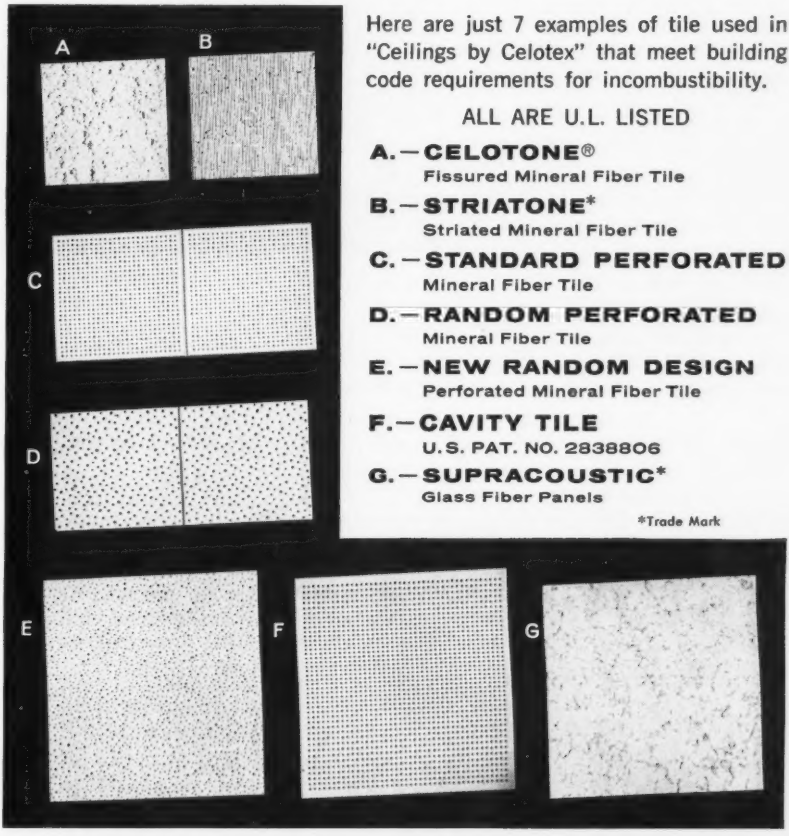
Tempo-Set Model A Fire Detector

Underwriters' Laboratories, Inc. Approved.

- Self restoring and can be heat tested.
- Electrical contacts are silver or gold and are enclosed.
- Very reasonable price.

- Tempo-set Model A is approved in either open or closed circuit and the temperature ratings are 135 and 200 degrees.
- Approved maximum distance between thermostats on smooth ceilings: 20 feet.
- Electric ratings are 125 volts 1 ampere, A.C. or 24 volts 0.5 ampere D.C. or less.

INCOMBUSTIBLE CEILING TILE
...and they're ALL "by CELOTEX"!



Here are just 7 examples of tile used in "Ceilings by Celotex" that meet building code requirements for incombustibility.

ALL ARE U.L. LISTED

A.—CELOTONE®
Fissured Mineral Fiber Tile

B.—STRIATONE*
Striated Mineral Fiber Tile

C.—STANDARD PERFORATED
Mineral Fiber Tile

D.—RANDOM PERFORATED
Mineral Fiber Tile

E.—NEW RANDOM DESIGN
Perforated Mineral Fiber Tile

F.—CAVITY TILE
U.S. PAT. NO. 2838806

G.—SUPRACOUSTIC*
Glass Fiber Panels

*Trade Mark

TRADE MARK

ACOUSTI-CELOTEX
REGISTERED U.S. PAT. OFF.

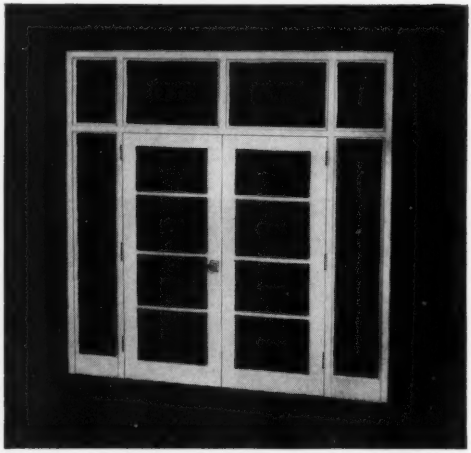
Sound Conditioning

Products to Meet Every Building Code
THE CELOTEX CORPORATION • CHICAGO 3, ILLINOIS
In Canada: Dominion Sound Equipments, Ltd., Montreal, Quebec

UL®

LABELED

Overly corridor smoke screen with ¾ HR (C) label is brand new fire protection equipment. May be specified for corridor fire barriers in hospitals, schools, institutional and public buildings.



OVERLY'S 1958-59 UL test program

Summary Report to Members of the National Fire Protection Association:

Overly, pioneer fabricator of hollow metal products to rigid standards, is helping to lower building costs and extend the scope of fire protection. Our extensive testing program at Underwriters' Laboratories began in 1958 with 5 major tests and will continue through 1959 with 3 tests scheduled.

Overly's labeled door frame service has been expanded to permit the use of smoke screens as fire protection equipment, and these will resist the passage of flames, heat or smoke for 45 minutes, ample time to evacuate a building. They can now be specified for corridor fire barriers in hospitals, schools, institutions and other public buildings.

Tests have proved that special constructions and expensive hardware are unnecessary for Class A doors. We are authorized to apply the 3 HR (A) label to lighter weight, less expensive doors provided with simpler, single-point hardware. As a further economy, most of our 3 HR (A) label frames may be fabricated in 16 gage.

Our tests have proved also that 20 gage hollow metal doors perform adequately for

METAL PRODUCTS SINCE 1880

Overly is the first hollow metal producer of A-labeled pairs with single-point locks for doors up to 6'0" x 7'0".

Overly 20 gage, B-labeled door with vision light. Non-labeled door has same construction, except core material is fiberboard instead of air cell asbestos.

Overly 1½ HR labeled frame assembly with removable mullion permits installation of labeled pairs of doors with panic devices and use of full width opening when necessary.

cuts building costs, adds fire safety

fire protection. Overly's A-, B-, C-, D-, and E-labeled doors and non-labeled doors are identical in construction – except that 3 HR (A) label requires 18 gage.

Overly frames with removable mullions have been approved, too, for label service where up to 1½ hours of fire resistance is required.

Other authorized modifications of Overly labeled hollow metal doors and frames are:

- Preparation of both doors and frames for floor checks and top and intermediate pivots
- Labeled rough bucks and cabinet jambs for use in existing openings or where job progress demands that wall construction proceed before frames can be delivered
- Preparation for GJ#64 rubber bumpers and adjustable floor clips.

As a result of the test program, we have all new specifications for 1959. For details, write us today for our 1959 Door & Frame Catalog, now ready.

Overly UL labeled frames can now be provided with transoms up to 48" in height.

Overly UL labeled frames may have up to 30" wide side lights, one or both sides, and with or without transoms.

OVERLY MANUFACTURING COMPANY

Greensburg, Pa. • Los Angeles 39, Calif.

Nation Wide
Central Station Protection Services

Sprinkler Valve Alarm — Complete Sprinkler Supervisory — Manual Fire Alarm — Automatic Fire Alarm — Temperature Alarm — Oil Burner Supervision — Burglar Alarm — Hold-Up Alarm — Vault & Safe Protection

Available from these members of

Central Station Electrical Protection Association

ALBANY, NEW YORK ..... **ALBANY PROTECTIVE SERVICE**
99 Jay Street

BOSTON, MASS. ..... **CALL'S POLICE SIGNAL CORP.**
69 Washington Avenue, Chelsea

CHICAGO, ILLINOIS ..... **CENTRAL WATCH SERVICE**
214 West Ohio Street

CLEVELAND, OHIO ..... **MORSE SIGNAL DEVICES**
6707 Carnegie Avenue

DALLAS, TEXAS ..... **SMITH DETECTIVE AGENCY & NIGHTWATCH SERVICE, INC.**
610 N. Akard Street

DENVER, COLORADO ..... **DENVER BURGLAR ALARM COMPANY, INC.**
422-21st Street

DETROIT, MICHIGAN ..... **MICHIGAN STILL ALARM CO.**
10410 W. Chicago Blvd.

HONOLULU, HAWAII ..... **CENTRAL ALARM COMPANY, LTD.**
1755 Kapiolani Boulevard

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1612 Austin Street

LOS ANGELES, CALIF. ..... **MORSE SIGNAL DEVICES OF CALIFORNIA**
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839 Elm Street

MILWAUKEE, WIS. ..... **MERCHANTS POLICE SIGNAL & ALARM CO.**
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NEWARK, NEW JERSEY ..... **NEWARK DISTRICT TELEGRAPH CO.**
372 Plane Street

NEW YORK, NEW YORK ..... **CENTRAL STATION SIGNALS, INC.**
53 West 23rd Street

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PHILADELPHIA, PENNA. ..... **OWL PROTECTIVE CO., INC.**
120 No. Camac Street

ST. LOUIS, MISSOURI ..... **POTTER ELECTRIC SIGNAL & MFG. CO., INC.**
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SAN FRANCISCO, CALIF. ..... **PACIFIC FIRE EXTINGUISHER CO.**
AMERICAN BURGLAR ALARM DIVISION
165 Jessie Street

WASHINGTON, D. C. ..... **FEDERAL ENGINEERING CO., INC.**
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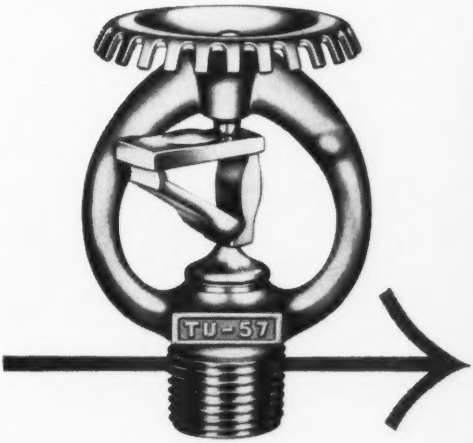
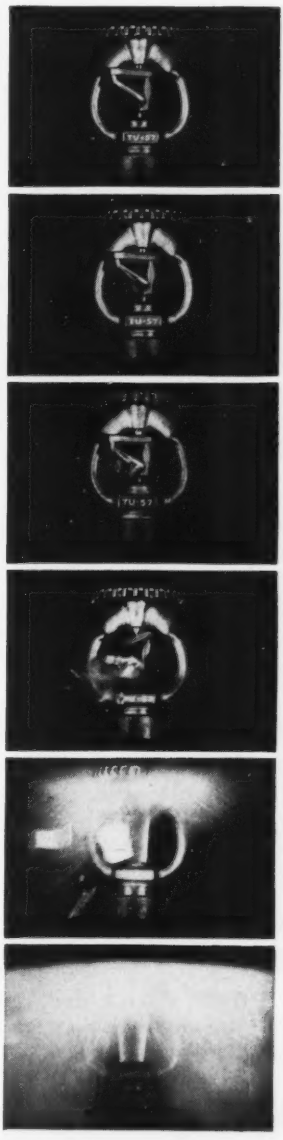




Protection

in one-tenth of a second!

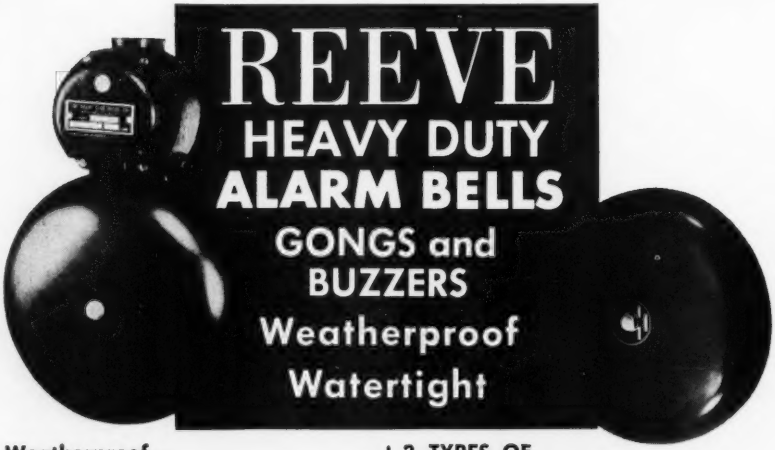
The eye of the high-speed movie camera shows you what the human eye is not quick enough to see — the actual operation of the Rockwood WaterFOG Sprinkler Head. And it all happens in one-tenth of a second after the solder starts to melt. Then water sprays out to put out the fire fast.

Rockwood can engineer a complete fire protection system for you — a wet, dry pipe or Dualguard system. Whatever your special fire hazard problem, small or large, Rockwood can solve it!

Write for Rockwood's booklet, "Do You Have a Hidden Enemy in Your Plant?" It lists dangerous hazards and how to protect your plant from the fire losses they can cause. Tested and listed by Underwriters' Laboratories, Inc. Rockwood Sprinkler Company, 2970 Harlow Street, Worcester 5, Mass.

ROCKWOOD SPRINKLER COMPANY

Engineers Water...to Cut Fire Losses



REEVE
HEAVY DUTY ALARM BELLS
GONGS and BUZZERS
Weatherproof Watertight

Weatherproof —
Sizes 3", 4", 6", 8", 10", 12"
DC—6—220 V. • AC—12—220 V.

Watertight —
Sizes 3", 4", 6", 8", 10", 12"
DC—6—220 Volt • AC—12—220 Volt
60 Cycles, 110—220 Volt, 25 Cycles

3 TYPES OF
UNDERDOME BELLS
OPEN PIGTAIL • WEATHERPROOF • E-Z MOUNT
Sizes 6", 8", 10". Cast aluminum housing
Hot Pressed Steel Gong Shell
Single Stroke and Vibrating Types
Voltages are the same as Neck Type

Special Windings on request.

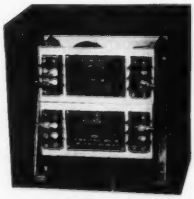
Seal of approval by UNDERWRITERS' LABORATORIES • FACTORY MUTUAL LABORATORY, INC. • UNITED STATES COAST GUARD

Write for Catalog Material and Prices!

AUTOMATIC BATTERY CHARGER, High and Low Current

The unit is designed for use on any storage batteries not subject to heavy drains. It will trickle charge the battery indefinitely because of its automatically decreasing rate of charge.

For use with six cells (12 volts). Automatically controlled by saturable reactor. Continuous output one ampere. 22.5 watts, 118 volts, 60 cycles. 3% Regulation. 9" x 9" x 6" — 14 B & S gauge steel wall cabinet. 15¼ lbs. U.L. Approved. No moving parts.



MODEL BC-12

Manufacturers of a complete line of

CENTRAL OFFICE and LOCAL FIRE ALARM DEVICES

• automatic alarm devices • sprinkler alarm and supervisory devices • burglar alarm devices and accessories. DYNALARM (sound detection for both reverberant and non-reverberant vaults).

THE REEVE ELECTRICAL CO., Inc.
132 Lafayette Street, New York 13, N. Y.

NOW... Kuhns ductile iron fittings

For Sprinkler Systems

Kuhns ductile iron pipe fittings—the newest development in piping—provide an extra margin of operating safety for sprinklers, high pressure lines and other vital piping systems. High structural strength and resistance to thermal shock help these fittings prevent leakage caused by vibration, temperature changes or misalignment.

"K" Pipe Lock Couplings

Listed for 800 psi by Underwriters' Laboratories, Inc., these couplings have a safety factor of five times the UL listing for 2½" through 6" and four times UL listing for 8". Sizes: 2½" through 8". Look for the "800 D" on each.

"K" Flanges and Flanged Fittings

Pressure rating, 500 psi by Underwriters' Laboratories, Inc. for elbows, base elbows, 45° elbows, side outlet elbows, tees, side outlet tees, and reducers in straight and reducing sizes. Flat faced flanges standard. Extra heavy flange dimensions and raised faces available. Look for the "DI 500" on each.

Complete range of sizes through 12".

"K" Screwed Fittings *

Pressure ratings listed by Underwriters' Laboratories, Inc.

STEAM AND OIL AT 550°F

¼" to 3".....300 lbs.

LIQUID AND GAS AT 150°F

¼" to 1".....2000 lbs.

1¼" to 2".....1500 lbs.

2½" to 3".....1000 lbs.

**Ductile iron fittings are available in any size in Kuhns complete cast iron line, ¼" through 12".*

Note: These fittings are excellent for liquefied petroleum gas systems. Look for the "DI 300" on each.

Send for our catalog or contact your wholesaler.

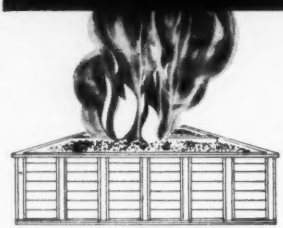
THE KUHNS BROTHERS CO.

1800 McCALL STREET, DAYTON, OHIO

1887 • 71 Years of Continuous Progress • 1958

NON-COM

Beginning of Test on Non-Com Treated Lumber, Factory Mutual Laboratories, Norwood, Massachusetts.



A NEW CHEMICAL DEVELOPED BY KOPPERS MAKES WOOD NON-COMBUSTIBLE

NON-COM salts is a new and highly effective chemical that imparts superior fire resistance to wood and protects it against rot and termites. Lumber treated with NON-COM salts becomes an entirely new construction material. It has all of wood's warm appearance and insulation value plus the new property of non-combustibility.

Underwriters' Laboratories has established a classification of 10-15 for NON-COM treated lumber, the lowest flame spread rating ever given to wood. Tests conducted by Underwriters' Laboratories on NON-COM fireproofed lumber gave no evidence of progressive combustion in a 30-minute test period. NON-COM treated lumber and plywood have been approved by Factory Mutual Engineering Division and the Factory Insurance Association where class #1 roofs are required.

The perfection of NON-COM salts and treatment is another milestone in KOPPERS continuing research to make wood serve industry better.

781

KOPPERS COMPANY, INC.

KOPPERS ®

PRESSURE-TREATED WOOD

Wood Preserving Division . . . Pittsburgh 19, Pennsylvania

Kidde's complete dry chemical line kills more fire... faster!

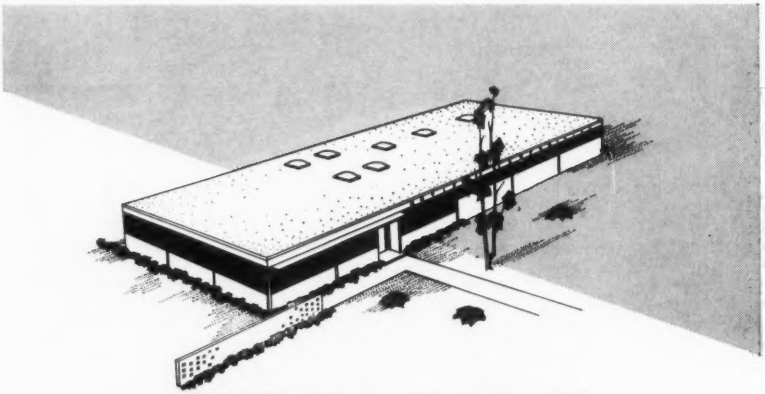
Kidde dry chemical extinguishers pack the *extra* punch needed for stubborn blazes, for *full-power* fire fighting. Available in pressurized 2½, 5, 10, 20 and 30-pound capacities, Kidde dry chemical units are easiest of all portables to operate. No valves to turn, no pins to pull, no bumping or inverting. Just aim, pull trigger, and fire's out! All are quickly and easily pressurized, have dust- and moisture-proof gauges which show when unit is charged.

The 200-pound Kidde pressurized wheeled unit discharges a 40-foot dry chemical stream, has an *extra* 50 pounds of dry chemical to knock down fire quicker. It's fast and easy to operate . . . remove pin, swing toggle lever, and flip on-off lever.

All Kidde extinguishers are granted top rating by Underwriters' Laboratories, are the finest extinguishers on the market today. Get more information about this *complete* line of *full power* fire fighting equipment. Write to Kidde today!

Kidde

Walter Kidde & Company, Inc.
451 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.,
Montreal—Toronto—Vancouver



NOTIFIER

Announces A New Building
With Facilities To Serve You Better . . .

- Flexible plant layout and smooth traffic flow assure customers of increased efficiency in producing systems of the highest quality.
- Enlarged facilities for sales engineering make possible those services required by a growing field engineering organization specializing in plant protection systems.
- Ample space for research and product development will permit adding more products of advanced design to the Notifier line.
- A carefully designed plan of expansion provides for the addition of modular factory units as Notifier grows.

A NOTIFIER proprietary installation can qualify your plant for PREFERRED RISK CLASSIFICATION without high lease charges. Automatic fire detection, sprinkler supervision, and security control systems have been standardized to facilitate rapid production and economical service.

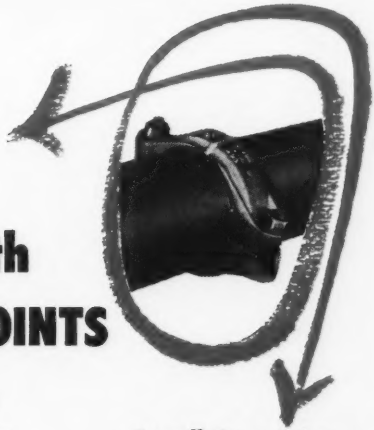
For information, see the "Yellow Pages" in your telephone directory, or contact the factory.

Note our new address

NOTIFIER CORPORATION
3700 North 56th Street
Lincoln 4, Nebraska

NOTIFIER Automatic FIRE ALARM

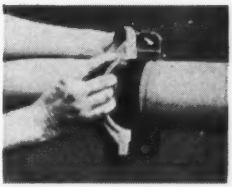
Couple Pipe the Easy, Low Cost Way with New G-B GRUVAJOINTS



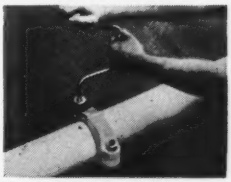
Now you can save up to 25% when connecting pipe for bulk runs and risers. Yes, contractors are saving money every day when they use new lightweight Gruvajoints. There's no flanging, no threading, no welding, and there's no need for heavy chain tongs or pipe wrenches. Gruvajoints are truly the modern way to couple pipe. Write today for free illustrated brochure on G-B Pipe Coupling Products. Gruvajoints are now available in 2", 2½", 3", 4", 5", 6" and 8" sizes.

Install Gruvajoints in three easy steps

Grease gasket and center over pipe ends.



Lay housing halves into grooves and insert bolts.



Tighten the two nuts equally.

LISTED by
Underwriters' Laboratories, Inc.
File EX 1741A and B

APPROVED by
Factory Mutual Engineering Division
Report Serial No. 13097

GUSTIN-BACON
manufacturing company
210 W. 10th St. Kansas City, Missouri

"Worthy of Your Confidence!"

Reliable Automatic Sprinkler Devices have been protecting life and property for more than 35 years. The practical design and rugged construction are universally approved and accepted by all Fire Insurance and Governmental Authorities. Reliable Automatic Sprinklers effect maximum reductions in fire insurance premiums.

Reliable's complete line provides a wide selection of Sprinkler Devices to meet any condition, including: Automatic and Open Sprinklers, Alarm Valves, Dry Pipe Valves, Accelerators, Electric Alarm Switches, Water Motors, and all Sprinkler System Accessories.

Experienced Reliable Licensees are located throughout the United States, Canada, and foreign countries. They are expertly qualified to design and install a Reliable Sprinkler System for your specific needs.

THE RELIABLE AUTOMATIC SPRINKLER CO. INC.

Chicago Bridge & Iron Company

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Plants

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Greenville, Pa.
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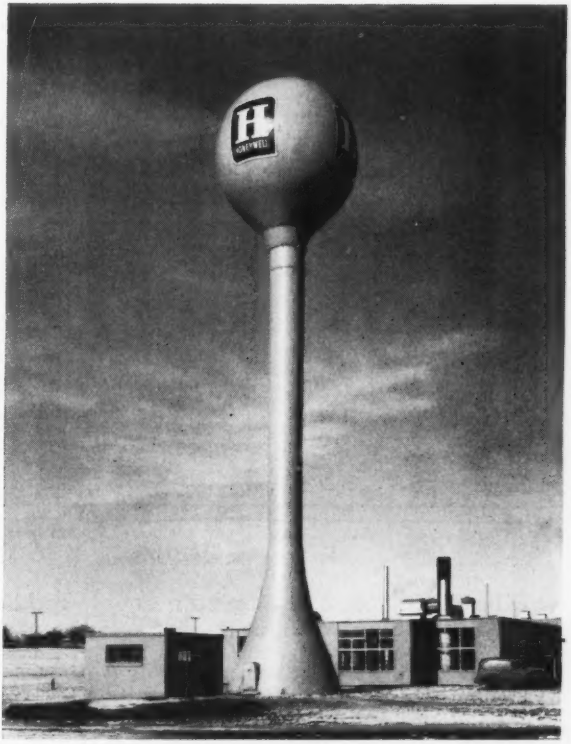
IN CANADA:
Horton Steel Works Limited



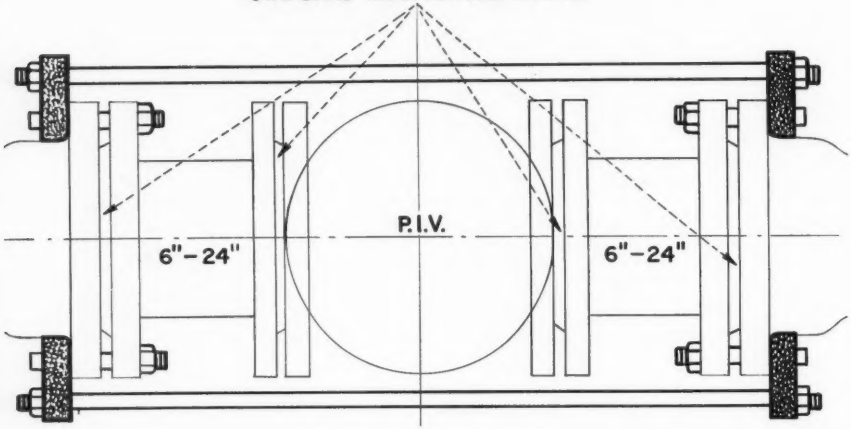
Minneapolis-Honeywell's New Plant Protected By Horton Watersphere

A 100,000-gallon Horton Watersphere, 100 feet to bottom, provides a dependable supply of water for fire protection and general use at the new Minneapolis-Honeywell Regulator Company plant at Golden Valley, Minnesota. The plant, a one-story building, has a floor space area of 263,000 square feet. A reserve of 75,000 gallons is maintained for both hydrants and sprinkler systems used for plant fire protection. Call or write the nearest CB&I sales office for a copy of the bulletin: *The Watersphere and Waterspheroid.*

Save **TIME** and **MONEY** with **NEW DILLEY LUGS** and **SPACERS** for Plant Fire Protection Systems

FIELD APPLICATION OF FIG. 96-F, NFPA NO. 24

STANDARD MECHANICAL JOINTS



Dilley Lug No. 312—patent pending

New Dilley Lugs No. 312 eliminate double rodding and save labor in P.I. Valve piping installation. Dilley Spacers No. 201 available for other applications.

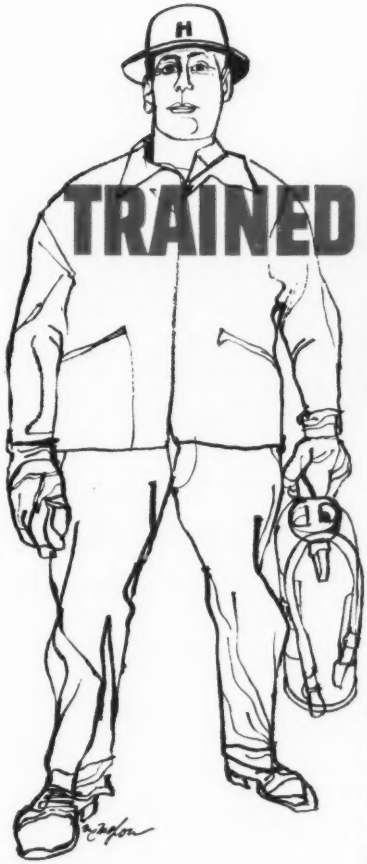
- Meet specifications for mechanical joint pipe anchoring in NFPA-NBFU NO. 24
- Lugs may be used on Tyton joint installations with mechanical fittings
- Factory Mutual approved for their insureds

LIST PRICE PER 100, Freight Prepaid
#312 LUGS $64.00 — #201 SPACERS $44.00
10% discount on lots of 1,000 either fitting

REGIONAL DISTRIBUTORSHIPS AVAILABLE — write to

PORTER D. DILLEY

P. O. BOX 363
PASADENA, CALIFORNIA



IN FIRE EMERGENCIES

TRAINED PEOPLE MAKE THE DIFFERENCE

Training your people is one of Ansul's most important jobs. In your own plant, at our Fire School in Marinette, Ansul experts instruct your men in the latest fire fighting techniques. This training is only part of Ansul's unique service program. In addition, you receive thorough fire protection surveys of your plant, visual aids to make your employees fire-prevention conscious. Trained men, fire prevention planning--plus Ansul fire extinguishing equipment give you the complete protection you need. Write us. Let us tell you about the Ansul service plan.

ANSUL CHEMICAL COMPANY / MARINETTE, WISCONSIN

FIRE EXTINGUISHING EQUIPMENT / INDUSTRIAL CHEMICALS / REFRIGERATION PRODUCTS / NATIONAL DISTRIBUTORS OF "FREON" REFRIGERANTS

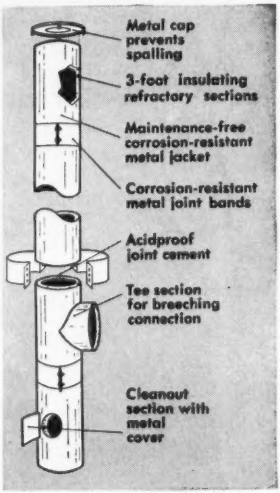
Van-Packer refractory smoke stack outlasts steel 3 times

Permanence — Van-Packer Industrial Stacks are made up of non-corroding refractory sections. Average life of the Van-Packer Stack is 3 times longer than steel, yet it costs no more than a comparable steel stack and 2/3rds less than brick.

For Boilers, Incinerators — Van-Packer *Standard* Stack for boilers and furnaces where flue gas temperatures do not exceed 800° F. based on continuous exposure. Abrasion-resistant Van Packer Hi-Temp Stack, ideal for incinerators, withstands 2000° F. continuous exposure.

Eight Diameters — Van-Packer Stacks are available in 8 diameters from 10 inch I.D. to 36 inch I.D. Wall thickness varies from 2 to 4 inches depending on diameter. Insulating qualities of refractory wall prevent heat loss, give draft equal to brick stack, greater than steel stack.

Test Data — Write for 32-page test data report from independent laboratories, and Bulletin IS-32 with complete product information and specifications.

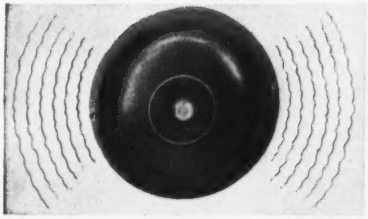

Metal cap prevents spalling
3-foot insulating refractory sections
Maintenance-free corrosion-resistant metal jacket
Corrosion-resistant metal joint bands
Acidproof joint cement
Tee section for breeching connection
Cleanout section with metal cover

VAN-PACKER

Division of FLINTKOTE *America's Broadest Line of Building Products*

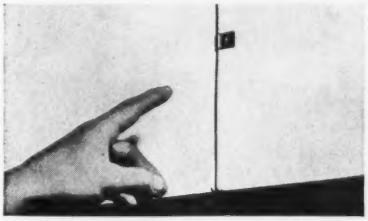
Van-Packer Co. 1232 McKinley Ave., Chicago Heights, Ill. • SKyline 4-4772

FIRE ALARM!

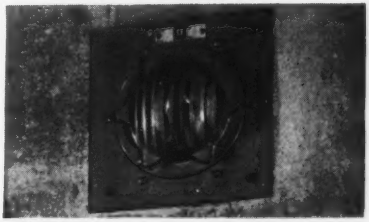


1. Save priceless lives, protect valuable buildings with the Kidde Atmo Fire Detecting and Alarm System!

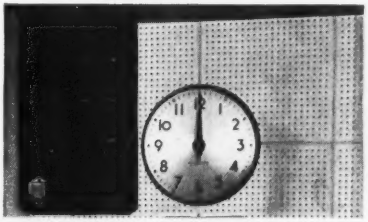
2. This automatic detecting and warning system sounds an alarm instantly at the *first* hot breath of fire!



3. Using rate-of-temperature-rise tubing as a sensing element, the system works without outside power!



4. Kidde's Atmo system can sound alarm at fire area, outside the building or at local fire department station!



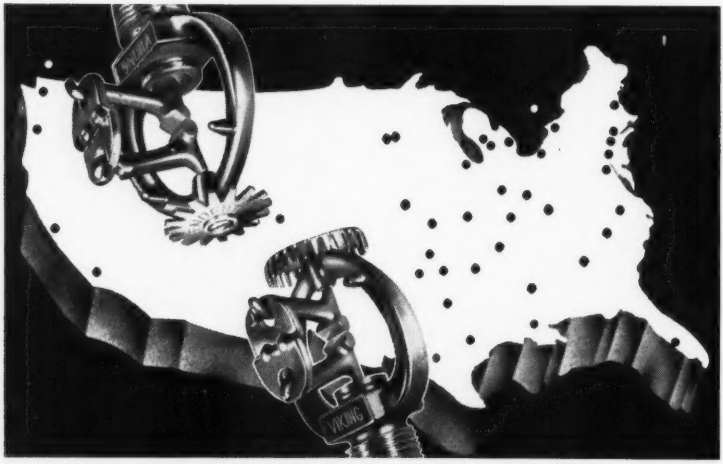
5. Kidde's Atmo system also gives fire location at a panel near any manned telephone switchboard!

Kidde Atmo

KIDDE ULTRASONIC & DETECTION ALARMS, INC.
451 Brighton Road, Clifton, N. J.

A Subsidiary of
Walter Kidde & Company, Inc.
Belleville 9, N. J.

FOR fast, dependable fire detection and warning, install a Kidde Atmo Fire Alarm System. Ideal where life protection and early fire warning is essential, the Kidde Atmo system can also close doors, shut off fans, motors, blowers, is automatically re-setting after use or test. Get more information! Write today and ask for Kidde's Atmo Alarm Systems booklet!



VIKING **FIRE PROTECTION**

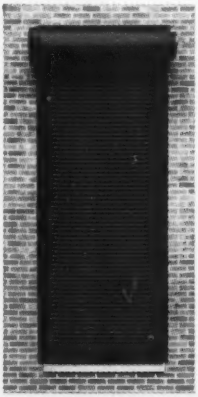
For fire control whatever it happens to be, call the nearest Viking Representative

ATLANTA — Crawford & Slaten Co. **BOSTON** — Viking Automatic Sprinkler Co. **BUFFALO** — Viking Automatic Sprinklers, Inc. **CHICAGO, MILWAUKEE** — Viking Automatic Sprinkler Co. **CINCINNATI, CLEVELAND, INDIANAPOLIS, LOUISVILLE** — Viking Sprinkler Co. **DALLAS, HOUSTON, JACKSON (Miss.), MEMPHIS, NEW ORLEANS, SAN ANTONIO, FT. SMITH** — Texas Automatic Sprinkler Corp. **DETROIT** — Viking Sprinkler Co. **GRAND RAPIDS** — Viking Sprinkler Co. of Western Mich. **HIGH POINT, N. C.** — Viking Sprinkler Co. **HUNTINGTON, W. VA.** — C. W. Hutchinson, Inc. **DECATUR (Ill.), DENVER, KANSAS CITY (Kan.), OMAHA, SAINT LOUIS, WICHITA** — Walton Viking Co. **LOS ANGELES, SAN FRANCISCO, PHOENIX** — California Viking Sprinkler Co. **HILLSIDE (N. J.), NEW YORK, MANCHESTER (Conn.)** — Viking Sprinkler Co. **PHILADELPHIA, WASHINGTON (D. C.)** — Viking Sprinkler Co. **PORTLAND (Ore.), SEATTLE, VANCOUVER (B. C.)** — Viking Automatic Sprinkler Co. **ST. PAUL, MINNEAPOLIS** — Hudson Viking Sprinkler Co. **TAMPA** — Florida Fire Sprinklers, Inc. **TORONTO (Ont.)** — Viking Automatic Sprinklers, (Canada) Ltd. **HASTINGS, (Mich.)** — The Viking Corporation.

the VIKING corporation

HASTINGS, MICHIGAN

Automatic Rolling Steel
FIRE DOORS *and* WINDOW SHUTTERS PREVENT SPREAD *of* FIRE!



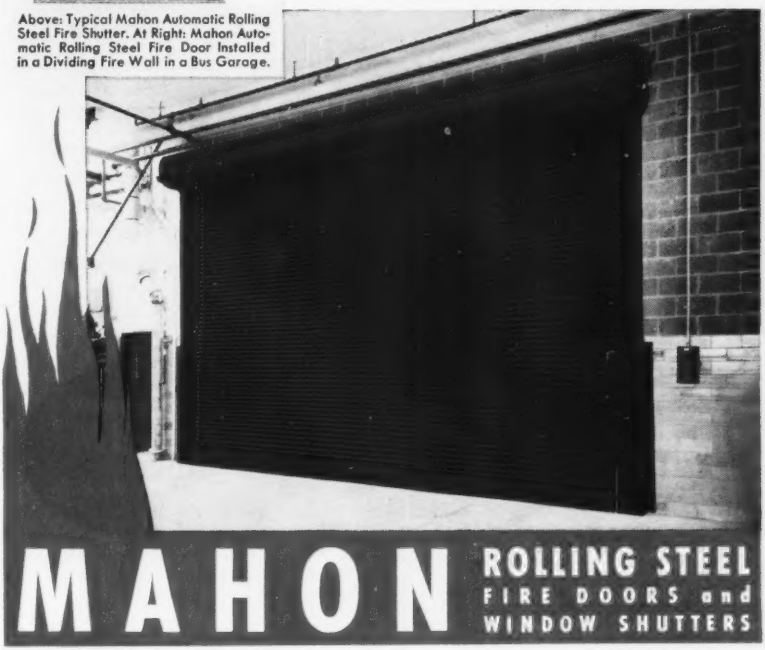
You need good automatic fire doors in fire walls, corridors, and vertical shafts . . . in some cases automatic rolling steel window shutters are necessary to protect your building and its contents from fires which may originate in nearby buildings. Many, many cases are on file which confirm that timely action of automatic rolling steel fire doors and window shutters have confined a fire to its point of origin and permitted its being extinguished with comparatively small damage. Make a survey of your building now, and don't delay action. You will find a Mahon Automatic Rolling Steel Fire Door or Window Shutter to meet each of your requirements—all bear the Underwriters' Label. These automatic fire doors may be operated manually or mechanically in every day use. If a fire should break out while they are in the open position, the automatic mechanism will close the door, cutting off drafts and preventing the spread of the fire. See Sweet's Files for complete information, or write for Catalog G-59.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Branch Offices in New York and Chicago • Representatives in Principal Cities

Manufacturers of Standard and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Window Shutters; Underwriters' Rated Metalclad Fire Walls; Insulated Metal Curtain Walls; Electrified M-Floors; Steel Roof Deck; Acoustical Long Span M-Decks; and Acoustical and Troffer Forms.

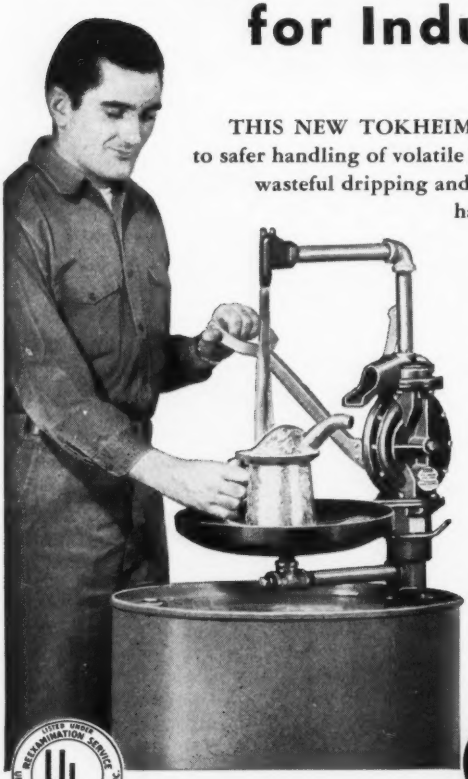
Above: Typical Mahon Automatic Rolling Steel Fire Shutter. At Right: Mahon Automatic Rolling Steel Fire Door Installed in a Dividing Fire Wall in a Bus Garage.



MAHON ROLLING STEEL FIRE DOORS and WINDOW SHUTTERS

SAFER

liquid handling for Industry



THIS NEW TOKHEIM HAND PUMP contributes to safer handling of volatile liquids wherever used. Stops wasteful dripping and slippery floors. Reduces fire hazard and accidents common to other methods of liquid transfer. Approved for handling petroleum liquids —ideal for many others. Available in 22 different models for 'most any use— from pipe lines to drums, or underground tanks, with hose or spout outlets. Order from your dealer, your oil company, or your Tokheim representative.

Write factory for literature.

QUALITY TOKHEIM HIGH VACUUM HAND PUMPS

General Products Division
TOKHEIM CORPORATION
DESIGNERS AND BUILDERS OF SUPERIOR EQUIPMENT SINCE 1901
1686 WABASH AVENUE FORT WAYNE, INDIANA

Subsidiaries: Tokheim International, A. G., Lucerne, Switzerland; GenPro Inc., Shelbyville, Indiana; Tokheim of Canada, Ltd., Toronto, Ontario

Check These Features of Kinnear "Akbar" Rolling Fire Doors

- *Automatic release in case of fire.*
- *Positive, spring-activated start.*
- *Operable after automatic closure.*
- *Easily raised and reset after periodic testing.*
- *Curtain can't travel beyond fully closed position.*
- *Also operable for regular daily service.*
- **Labeled by Underwriters' Laboratories, Inc.**

Whether you are considering new fire doors—*or checking existing ones*—make sure they have the features listed at right!

This combination of advantages is available only on modern AKBAR Rolling Fire Doors, made exclusively by Kinnear.

In today's AKBAR doors, *safety features for building occupants* have kept pace with other protective advances.

Fire doors should be checked periodically, to make sure they are in best operating condition. But out-dated fire doors, at best, can give you only part of the protection you may need. Kinnear AKBAR Steel Rolling Fire Doors, available in any size (within U/L limits), are labeled by Underwriters' Laboratories, Inc.

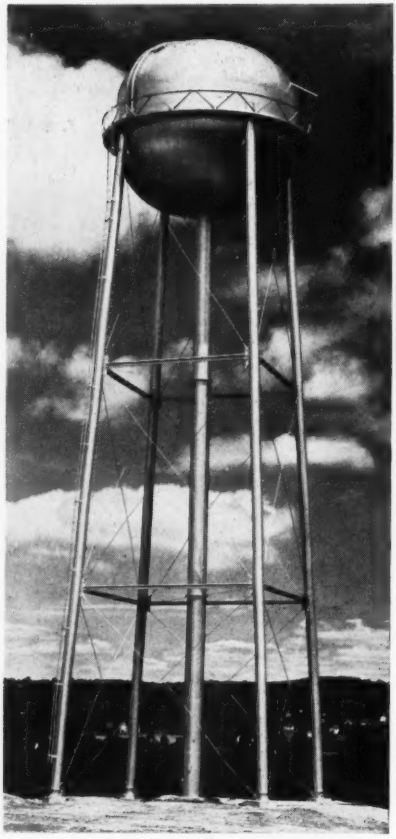
The KINNEAR Mfg. Co.
Offices and Agents in All Principal Cities

KINNEAR ROLLING DOORS
Saving Ways in Doorways

Factories: 2250-70 Fields Ave., Columbus 16, Ohio, 1742 Yosemite Ave., San Francisco 24, Calif.

THE PICTURE OF PROTECTION

for your plant operations



Pittsburgh-Des Moines ELEVATED STEEL TANKS

An ever-dependable water supply, as sure as the law of gravity—on your own property for your own plant service and protection! That's the net of modern water storage in Pittsburgh-Des Moines Elevated Steel Tanks. There's a type and size to match your process and fire protection requirements, at low cost and guaranteed satisfaction. Write for our comprehensive water storage brochure!

PDM
ELEVATED STEEL TANKS

Pittsburgh-Des Moines Steel Company

Plants at PITTSBURGH, BALTIMORE, DES MOINES, SANTA CLARA, FRESNO, and STOCKTON, CAL.

Sales Offices:

PITTSBURGH (25).....3468 Neville Island
BALTIMORE (26).....Curtis Bay Station
NEW YORK (17).....Suite 2750, 200 E. 42d St.
CHICAGO (3).....672 First National Bank Bldg.
EL MONTE, CAL.....P. O. Box 2012
ATLANTA (5).....361 E. Paces Ferry Rd., N.E.
DES MOINES (8).....969 Tuttle Street
DALLAS (1).....1273 Praetorian Bldg.
SEATTLE (1).....Suite 376, 500 Wall St.
SANTA CLARA, CAL.....675 Alviso Road
DENVER (2).....323 Railway Exchange Bldg.

Where there's smoke...

it's almost certain one or more of the dependable, high-quality fire fighting products... known by these famous brands... will be called upon to fight the fire!

Consolidated under a single organization, these brands comprise the most complete line of competitively-priced fire protection products and services ever offered. This means you can guard against every fire risk by contacting a single source for all these products: approved fire extinguishers; automatic sprinkler systems; carbon dioxide, dry chemical and foam systems; fire hose, nozzles and couplings; alarm systems; and fire department accessories including ladders, sirens, clothing, breathing apparatus, first aid kits, etc.

Representatives of this broad product line, with their depth of knowledge and experience in all industrial, commercial, institutional, municipal and household fire hazards, are uniquely qualified to *survey, analyze* and *recommend the proper equipment* for every fire protection requirement. To contact the representative nearest you, look in the yellow pages under "Fire Protection Equipment" or write to:

THE FYR-FYTER COMPANY

ATLANTIC COAST REGIONAL OFFICE
P. O. Box 750, Newark 1, New Jersey

CENTRAL STATES REGIONAL OFFICE
221 Crane St., Dayton 2, Ohio

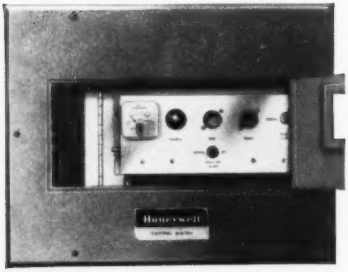
PACIFIC COAST REGIONAL OFFICE
132-140 Hawthorne St., San Francisco 7, Calif.

BRANCHES: Atlanta, Baltimore, Boston, Chicago, Dallas, Dayton, Detroit, Los Angeles, New York, Newark, Philadelphia, Pittsburgh, Portland, Rochester, San Francisco, Seattle, Toronto (Ontario). Representatives and Distributors in all principal cities.

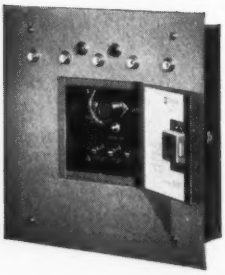
For COMPLETE Protection...

Honeywell's Line of Automatic Fire Detection and Alarm Systems

For the most up-to-date fire protection, choose a Honeywell automatic fire alarm system. The Honeywell panels shown are typical of the many available. They provide the ultimate in personnel evacuation and property protection. To complete your system Honeywell offers a full line of automatic detectors, manual pull stations, horns, gongs, buzzers and related equipment. All are U.L. approved, and backed by fast, efficient Honeywell service and maintenance. For more information phone your nearest Honeywell office or write Minneapolis-Honeywell, Dept. QN-4-65, Minneapolis, Minnesota.



W247 Panel for the ultimate in detection and alarm for safe evacuation in buildings of all sizes. The panel features large bell capacity—up to 5 bell circuits operating a total of up to 50 bells. Choose from 3 types of alarms: *continuous ringing*, *master coded* and *selective coded* (bells ring in code to identify fire location). This panel features supervision of both the detection and alarm circuits.



W237 Panel for maximum protection of property and the ultimate in fire alarm reliability. Available with standby battery operation so alarm will sound even during a power interruption. This system is designed so that it can sound the fire alarm even with a break or ground in the detector wiring.

The detection circuit is completely supervised, and two independent alarm circuits are provided. Numbered lights on the panel quickly and positively indicate the fire location. Both detection and alarm circuits are low voltage.

Honeywell

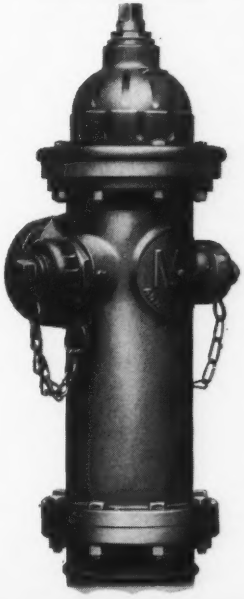
H First in Control

ALWAYS-READY GUARDIAN OF *LIFE AND PROPERTY*

MH

COMPRESSION TYPE FIRE HYDRANT

Above: Standard Model.
Below: Traffic Model.

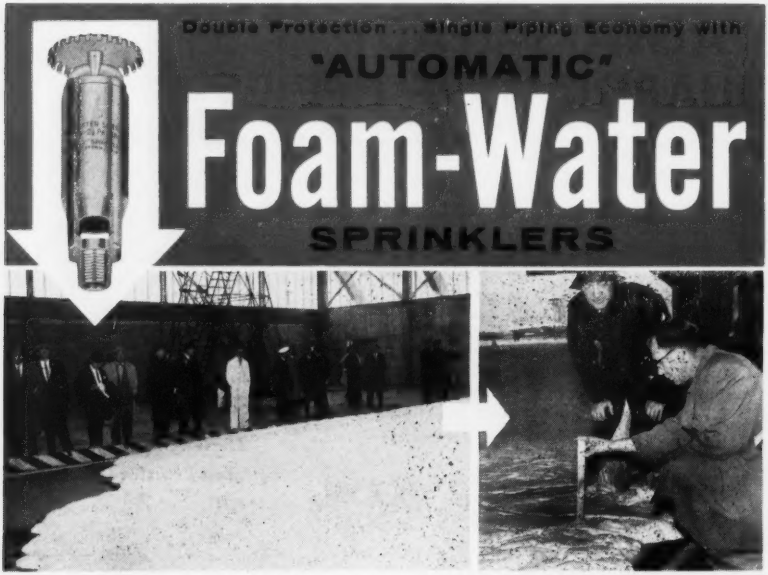


Although an M & H Fire Hydrant may stand idle for years, without a moment's notice it functions perfectly. Its simple rugged design and careful manufacture from highest quality materials is the reason.

Large diameter, unobstructed waterway gives high flow efficiency when large volume of water is needed to fight fire. All operating parts are bronze or bronze bushed. Furnished either in accordance with A. W. W. A. specifications or Underwriters and Factory Mutuals approved; also either standard model, traffic model or flush type. For complete information, address

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

SUBSIDIARY OF W WALWORTH



The leading edge of Airfoam beyond system discharge.

Measuring the foam depth at Canadian Pacific Airlines hangar, Vancouver, B. C.

FOAM-WATER Sprinkler Systems function like a deluge system by spraying foam from sprinkler heads, thus reducing structural temperatures as the foam blankets the floor. Fires caused by leaking or spilled flammable liquids are smothered and combustion at floor level is prevented from spreading.

This system automatically changes from foam to water discharge when the foam supply is exhausted and can be changed manually to water at any time. Generally, no re-design of piping is required to adapt FOAM-WATER to existing deluge sprinkler systems.

The FOAM-WATER sprinkler system is a product of "Automatic" Sprinkler's industry-leading research laboratories . . . also pioneers in

- **Rate-of-Rise**
- **Hydraulically-designed Sprinkler Systems**
- **Fire Fog Systems**
- **Deluge Systems for Aircraft Hangars**
- **High Speed Fire-Fog**
- **Automatic Fixed-Pipe Dry Chemical Systems**

Write for Bulletin 73 or contact your local "Automatic" Sprinkler representative for the ***complete fire protection assistance*** *that only three-quarters of a century leadership can offer.*

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

A

A Tragedy In Chicago...

was told in grim detail recently in newspaper headlines across America. 91 children and three adults lost their lives in a Chicago school fire. The news stunned the nation.

We at Gamewell are deeply concerned. Our sole business for over 100 years has been automatic fire detection and alarm systems. We know that science has provided equipment to prevent such tragedy.

Tragedy is a teacher. But often, after the headlines have faded, tragedy's greatest ally — *a man's own short memory* — lulls communities into complacency. Chicago's disaster gives mute testimony of the great danger of fire — and that hazards of fire are everyone's business.

If you are concerned with the safety of your children in your community's schools, have your Fire Chief, or School Board Official contact a Gamewell engineer. He is a highly trained expert in fire detection who can give you information, examples of fire alarm installations, and he will survey your buildings.

He is backed by the largest plant in the world engaged exclusively in the manufacture of fire and other emergency signalling systems and equipment. Have your official phone the nearest Gamewell office — we will gladly accept the charges.

HOME OFFICE:
Newton Upper Falls, Massachusetts
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South Gate, Calif.
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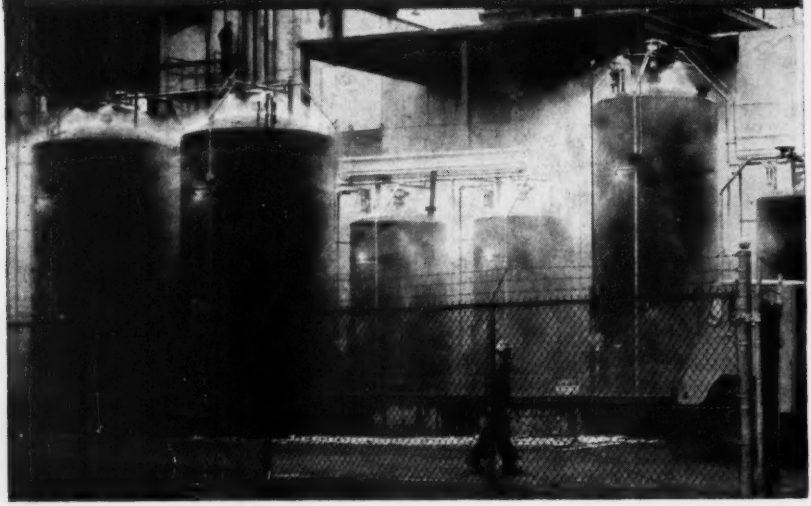
Oswego, Oregon
Phone: NEptune 6-3745

Tallahassee, Florida
Phone: 3-3794

GAMEWELL®

THE GAMEWELL COMPANY
First When Seconds Count

Grinnell water spray system controls tank fires and prevents their spread



Proper safeguards are uppermost in importance in protecting tanks which contain gases and flammable liquids in the event of fire. For example, tanks must be guarded against extreme heat exposure. Leaking gas, if it should develop, must be diluted to the point where it will not burn. And fire, if it should occur, must be localized and controlled or extinguished without needless delay.

With a Grinnell Water Spray System, you get protection against all these different kinds of eventualities.

Before heat raises tank temperatures dangerously, an enveloping spray of water provides instant cooling, reducing internal pressure which helps prevent rupture. In addition, air turbulence is created (even in still air) which, in conjunction with the water vapor from the spray, helps dilute the flammable vapors controlling or extinguishing the fire. Flammable products which cannot be safely extinguished can be burned off under the protecting water spray with no damage to protected equipment which might be located near at hand.

There is a Grinnell Fire Protection System for every fire hazard. Call on Grinnell for advice about the one suited to your needs. Grinnell Company, 277 West Exchange Street, Providence 1, R. I.

GRINNELL

FIRE PROTECTION SYSTEMS SINCE 1870